Agriculture in the Americas

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NAMES & NEWS

Ross E. Moore Returns From Latin America

Ross E. Moore, Chief, Technical Collaboration Branch, Office of Foreign Agricultural Relations, recently returned to Washington from a visit to Ecuador, Peru, and Colombia. The purpose of this trip was to assist with the development of the Experiment Station Program in those countries, with special emphasis on the production of strategic and complementary crops and the formulation of a long-time program conducive to Hemispheric stability and goodwill. While in Ecuador Dr. Moore attended the meeting of the Board of Directors of the Corporación Ecuatoriana de Fomento.

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To Survey Timberland

Laurence V. Teasdale and *James W. Girard*, U. S. Forest Service, have been assigned to Puerto Rico, Haiti, and the Dominican Republic to conduct studies of the forest and timber resources available for the establishment of wood-using industries in those countries. They will make reconnaissance estimates of the quantity and quality of the timbers available and of the cost of extracting and shipping timber to points of use. This information will aid in establishing small wood-using industries in those countries.

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Olen E. Leonard Leaves For Latin America

Olen E. Leonard, Rural Sociologist for the Office of Foreign Agricultural Relations, will leave early in January for Nicaragua, Guatemala, and Mexico. In Nicaragua he will assist in conducting a survey in rural social organization to aid in establishing an extension program. He will spend some time in Guatemala investigating the possibilities for a similar program and in Mexico Dr. Leonard will confer with Dr. D. Spencer Hatch, Director of the Mexican Rural Reconstruction Program.

Visitor From Ecuador

Dr. Pio Jaramillo, President of the Institute of Indian Affairs of Ecuador and a member of the faculty of the University of Quito, is visiting the United States as a guest of the Department of State. Dr. Jaramillo is recognized internationally as an authority in the field of Indian Affairs. He is visiting various Indian educational centers in this country and will deliver several lectures on the art and literature of Ecuador.

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Chilean Agronomists Visit Here

Señores Hernan Frias and *Guillermo Rolando Diaz*, agronomists from Santiago, have been invited by the Department of Agriculture to spend a year in the United States observing agricultural methods. Señor Frias will investigate Extension Service methods and Señor Diaz will study soil conservation. Upon returning to Chile both men will spend 2 years in the Ministry of Agriculture.

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Assigned to Special Studies

Senhor Moacyr Wanderly, Brazilian agriculturist, arrived in the United States recently as a guest of the Institute of Inter-American Affairs. After a brief stay in Washington Senhor Wanderly will be assigned special studies in the agricultural field.

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Visitor From Chile

Señor Raul Torres Cereceda, Chief, Technological Section, Department of Arboriculture, Santiago, will take work in horticulture at the University of California and will visit canning factories, dehydrating plants, and fruit and vegetable packing plants.

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Agronomist From Brazil

Senhor Benjamin Gastal, Filho, of the Agronomy School of Pelotas, Brazil, has come to the United States as a guest of the Institute of Inter-American Affairs. During his stay at some North American university, Professor Gastal will study food production.

Agriculture IN THE *Americas*

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Bamboo Culture in the Americas

This article presents some scientific information on the cultivation of bamboo in the Western Hemisphere for domestic uses, which is still more or less in an experimental stage.

by F. A. McCLURE

The cultivation of bamboo is so nearly universal in the tropical and warm temperate areas of the Orient that the correct procedures and techniques are common knowledge among the rural populations there. In the Western Hemisphere, however, plantings of bamboo are still so rare and so casually observed that its cultural requirements are known by relatively few people.

In the United States a sharp increase in popular interest in bamboo became evident during the earlier decades of this century. This development was brought about largely through the enthusiastic efforts of Dr. David Fairchild and Dr. B. T. Galloway in this country, Dr. E. O. Fenzi, of Florence, Italy, (later known in American horticultural circles as Dr. Francisco Franceschi), and M. Houzeau de Lehaie, of Mons, Belgium.

During this period many kinds of bamboo were introduced here for trial, by way of Europe or from the Orient directly. Many papers on bamboo culture appeared in this country and in Europe. Nurseries did a thriving business in bamboo plants. The Division of Plant Exploration and Introduction, U. S. Department of Agriculture, distributed much propagating material, with cultural directions, to qualified experimenters.

These early plantings were made principally for ornamental purposes. Because of the slow development of the plants in their early stages of growth, many persons paid little attention to them until they had invaded the lawn, the flower beds, and the gravel walks, and seemed a liability instead of a potential asset. After this they were either tolerated with increasing annoyance, or were eradicated. Only exceptionally were efforts made at rational control and utilization.

Recently an extensive interest in bamboo from Western sources has been aroused as a result of the threatened depletion of our supplies of industrial bamboos from the Orient. The outcome promises to be a more general effort to cultivate bamboo in the Americas for domestic consumption. One symptom of this trend is a marked increase in the number of requests received by the U. S. Department of Agriculture for information on Western Hemisphere sources of bamboo and its cultivation.

Courtesy of Smithsonian Institution

Lush hedge of *Bambusa tuldoides* Munro along the road from Rio de Janeiro to Itatiaia, Brazil. This versatile economic species, probably introduced from the Portuguese colony, Macao, in southern China, where it is native, was so common 75 years ago that Doell (*"Gramineae,"* in Martius' *Flora Brasiliensis*) described it as a native species, *"Guada pubescens* Doell."

The author is Field Service Consultant on Bamboo for the Office of Foreign Agricultural Relations. At one time he served as Professor and Curator of Economic Botany at Lingnan University, Canton, China, and conducted special research on Chinese bamboos. Under the auspices of the Smithsonian Institution Dr. McClure recently carried on a special research project on bamboos from Western Hemisphere sources.

Photo by S. K. Maak

The lower nodes of many bamboos bear rings of aerial roots, a visible sign of the superior suitability of this part of the culm for propagating new plants by stem cuttings. *Bambusa lapidea* McClure, a locally important Chinese economic species in the bamboo garden established by the author at Lingnan University, Canton, China.

First-hand Observation Indispensable

Already a considerable volume of literature on the subject of bamboo culture has been published in Western languages. Most of this relates to those species introduced into Western countries from the warm temperate regions of China and Japan, while little is known about the bamboos native to the Western Hemisphere. Consequently, some of the generalizations which have been made concerning Oriental species are apt to be misleading if applied to Western Hemisphere bamboos.

One of the most frequently encountered generalizations is that bamboos require, or thrive best in, well-drained soil. Bamboos native to the United States, however, are said to reach their best development in swampy land, even though the fact has been little noted. Recent personal observations, moreover, on certain species of *Guadua* bamboo, as they occur naturally in the valley of the Cauca River, Colombia, and in the valleys of the Orinoco and Caura Rivers in southern Venezuela, seem to indicate that these species reach their best development under similar wet-soil conditions.

Our knowledge of the subject being limited as it is, to give at this time detailed directions for the culture of any Western Hemisphere bamboo is neither feasible nor desirable. There are, however, certain general indications which may be safe and helpful, and an attempt to state some of these is made in the following pages. Anyone undertaking to cultivate any bamboo for the first time will do well to inform himself concerning the conditions under which that particular species achieves its best development in its native habitat and the differences exhibited by the same species in different habitats.

Selection of Bamboos for Cultivation

Several lines of evidence should be investigated in determining which bamboos to plant. Special consideration should be given to the products or purposes for which bamboo is to be grown, and information sought with regard to the various species and varieties of which propagating material may be available. It is important to recognize the fact that the different bamboo species vary widely in the thickness and technical properties of their wood, in the size, shape, internode length, branching and other characteristics of their culms, and in the suitability of the shoots for food. To plant just any available bamboo is to invite possible disappointment in the outcome.

The known economic bamboos occur principally in certain genera. In warm temperate areas the principal economic species are found in the Oriental genera *Phyllostachys* and *Arundinaria,* while in the frost-free areas of the Tropics the most useful kinds belong to the Oriental genera *Bambusa, Cephalostachyum, Dendrocalamus, Melocanna, Schizostachyum,* and *Sinocalamus.* Of the Western Hemisphere bamboos the useful species belong to the tropical genera *Guadua* and *Merostachys,* with a few others of undetermined generic affinities, as far as our present knowledge goes. For such purposes as suitable sources of paper pulp and cellulose for rayon, the choice may be fairly wide, but for other purposes the specific suitability of a given bamboo may be rather narrow.

The Division of Plant Exploration and Introduction of the U. S. Department of Agriculture issues annually, in normal times, a list of plants available to qualified experimenters, with detailed information on the distinctive features, principal uses, and climatic and cultural requirements of each kind. The same agency will furnish a list of the commercial nurseries of the United States offering bamboo plants for sale. Plants of economic bamboos for tropical areas may be secured from the Puerto Rico Agricultural Experiment Station at Mayagüez and, probably, from the Experiment Gardens at Summit, Canal Zone, by special arrangement.

Again, sources of propagating material of suitable species may be discovered locally. These have the advantage of permitting first-hand investigation of the properties of the bamboo itself and its response to particular local environments.

When the selection has been made, a place should be chosen for establishing the plants for a period of observation and propagation, during which time the site for the more extended plantings may be selected and prepared.

New bamboo plants may be produced by two general methods—by germinating seeds and by rooting vegetative fractions or cuttings.

Propagation by Germinating Seeds

The "seed" of most bamboos is a dry, one-seeded fruit called a caryopsis, which bears a readily recognizable resemblance in size and shape to a grain of wheat or oats.

The propagation of bamboos by means of seeds may have the advantage of economy in per unit cost of propagating material, in its transportation, and in labor for preparation of the beds, but transportation over long distances presents serious difficulties because the seeds of most bamboos do not naturally retain their viability more than a month or so. Viability may be preserved for a longer period, however, by keeping them under special conditions designed to inhibit the development of fungi and to retard the loss of moisture without interfering unduly with the physiological processes of the embryo. The viability of the seeds of certain species of bamboo has been preserved at a high percentage for as much as 2 or 3 years by sealing them in tin containers, according to brief reports of experiments carried out in India. The moisture content of the seeds at the time when they were sealed up and the temperature at which they were stored were not reported, however.

The procedure for propagation by seeds should be based upon the conditions of soil and moisture prevailing in the habitat under which the bamboo reproduces itself in nature. Control to prevent extreme variations in moisture and temperature, which may be achieved by means of proper coverage with soil, mulching, shading, watering, and drainage, will result in a higher percentage of survival, however, than usually occurs in nature.

Propagation by Vegetative Fractions

Propagation by vegetative fractions may be carried out by a number of procedures, each with its own peculiar advantages and disadvantages. Several general principles are indicated.

First is the importance of care in making the cuttings. The cuts should be made carefully, with a sharp tool, in order to avoid damaging the tissues, especially the buds, which would invite their invasion by rot fungi. In general, the larger the fraction and the lower its natural position in the culm, the greater the chances of success. Roots develop most naturally at the nodes in the basal and underground regions of the plant. On the other hand, the smaller the fraction used, the greater the yield of individual plants from a given supply of material. At least one node is necessary in each cutting, for root formation takes place naturally in the zone just above the sheath scar.

Culm divisions of *Bambusa tuldoides* Munro taken from the bamboo garden at Lingnan University, Canton, China. These culms are about 9 months old, and the rhizomes of some of them have begun to establish root systems. One has its shoots for the current season beginning to push.

Courtesy of Smithsonian Institution

Nursery pots from the hollow internodes of culms of *Bambusa vulgaris* Schrad are widely used in tropical regions.

The presence of undeveloped and nascent (living) buds is likewise necessary; either the main branch bud or buds on the branches arising from the node will suffice. Foliage, when present, should be reduced drastically, though a few leaves or parts of leaves should be left unless there is danger of exposure to undue drying.

Naturally, vegetative fractions should be protected from exposure to sun and wind, as excessive loss of moisture is likely to weaken or even kill them. They should be set in the ground at the earliest possible moment after they have been prepared, and the earth must be well tamped about the base of each one. Under no circumstances should the earth be watered until the material has been well tamped in. If permanent planting sites have not been prepared, the cuttings should be heeled in temporarily or placed in the shade and kept covered with straw or moist burlap.

The proper time for propagation by vegetative fractions must be determined by the climatic conditions of the area. In general, the moment to prepare and put in such material is when the plants are dormant and at the end of a dry season.

By Division: The lower portion of the culm, together with the rhizome basal to it, is the unit most commonly used for propagation. For most bamboos with which we have had any experience (Oriental species), culms from 8 or 9 to 20 months of age give the best results. For reasons of economy the culms are usually taken up singly, but a unit composed of two or more culms gives surer and quicker results. The larger the unit, the less the time required for getting a clump to the production stage. This type of material may be set out directly in grove formation, unless it has to undergo serious exposure between the time of cutting and getting into the ground, in which case establishing it in nursery formation first may prove better economy.

If the culms are small enough so that they may be braced to prevent lodging, they may be left intact, but most of the foliage should be removed. Heavy culms should be cut back to a height convenient for handling.

The Puerto Rico Agricultural Experiment Station has used successfully the stump method for Oriental species of the clump bamboos. The culms are cut back to about a foot in height and a part of the root system is allowed to remain in a ball of earth. This ensures greater economy of the culm material and less danger of the plant's being disturbed, once it is set in the ground.

By Culm Segments or Cuttings: When the method of division is used, the upper portion of the culm which is cut off may be salvaged in part for increasing the available propagating material. The slender tip is removed, and the remainder, which has been left intact, may be buried in a horizontal position, or it may be cut into sections, each with one to three nodes, and these sections either buried in a horizontal position or set in vertically or on a slant, with one or two nodes well covered. It is important that the soil be tamped in firmly about the material. Mulch and partial shade are considered essential for the best results.

By Branch Cuttings: Certain Oriental species of clump (tropical) bamboos with heavy branches have been found to propagate readily by means of branch cuttings, especially those which have several short, prominently swollen basal internodes. These often show the ease with which they may be rooted by sending out aerial roots spontaneously at certain seasons while still in their original position. Advantages of this method are ease of handling and a high yield of individual new plants for each mother culm used. Disadvantages are the small size of the resulting individual plants and the greater length of time required to bring them to mature size, as compared with propagation by divisions.

By Rhizome Cuttings: Certain Oriental (warm temperate) species of open clump habit, with indeterminate (running) rhizomes, may be propagated readily by means of foot-long cuttings of the rhizome alone. The general principles enumerated above govern the selection and handling of this material. Rhizome cuttings are generally placed in a horizontal position, and covered to a depth of about three inches.

Growth-regulating Substances Or Plant Hormones

Important results in propagation have been achieved in recent years by the use of plant hormones and synthetic growth-regulating substances as a means of inducing cuttings of many kinds of plants to develop roots. No literature on the trial of such substances as a means of rooting bamboo cuttings has come to my attention. Here would seem to be a promising field for investigation. If a means could be found by which cuttings from the smaller branches and from the upper, hard-to-root parts of the culm could

be induced to strike root, an important economy of material would be made possible.

Moisture Relations

Although no precise scientific data on this subject have been encountered in the literature, the verdict of common experience is that bamboos require relatively large amounts of water. With the exception of certain strains of *Dendrocalamus strictus* (Roxb.) Nees, native to India, bamboo plants are generally sensitive to excessive drying-out of the soil, especially by dry winds of high, or even moderate, velocity. The imported bamboos familiar to us in the Western Hemisphere require a well-drained soil yielding a steady and generous supply of moisture and, in windy regions, a relatively sheltered situation, in order to make their best growth. On the other extreme, certain bamboos native to the Western Hemisphere seem to thrive best in poorly drained to swampy soil.

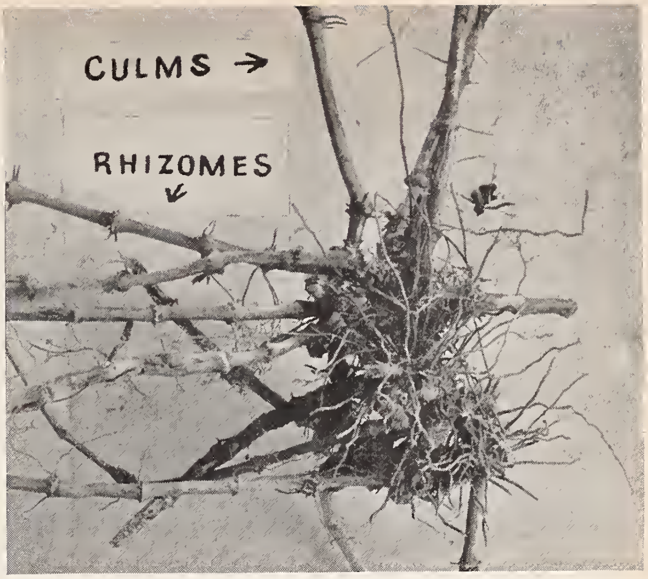
For both the seedling bed and the permanent plantings it is important to select a soil with the moisture conditions similar to those which prevail in the favored natural environment of the species. By irrigating, sprinkling, mulching, and keeping down the weeds, wide fluctuations in the power of the soil to deliver moisture to the plant should be prevented, particularly during the critical period when newly set-out plants are becoming established.

Sometimes excessive losses of water through evaporation or transpiration must be avoided by protecting the soil and the young plants against exposure to the direct rays of the sun, especially in the early stages of propagation or establishing new plantings. Simple lath shades may be made for the beds; the culms of large cuttings may be wrapped with fine dried grass, long-staple moss, or straw; or leafy branches may be stuck upright in the ground beside the newly set-out plants.

Soil Relations and Amendments

In transplanting bamboos, special attention should be given to bringing the soil into intimate contact with the roots and stem by tamping it firmly in place. Culms 3 feet or more in length may be bound to a firmly set stake to prevent any movement of the plant by wind or other agency which might break the contact between the roots and the soil. In China, when divisions are set directly in the place where permanent clumps are desired, two cuttings or divisions (usually 4-foot basal segments of the culm) are placed near each other in each hill and their upper ends tied firmly together. The extra division or propagule increases the likelihood of at least one survival, and if both survive there seems to be a certain advantage, in the early stages at least, in increased culm production per unit of land.

Another consideration is the reaction of the soil and its capacity for supplying the essential water-soluble nutrients. No published data on the preference or tolerance of any



Culm bases and indeterminate (running) rhizome system of *Chusquea simpliciflora* Munro. Bamboos with this type of rhizome spread rapidly and widely, once they are well established. Material from Rancho Grande, State of Carabobo, Venezuela, collected and photographed by Dr. H. Pittier, Director of the Servicio Botanico, Ministry of Agriculture, Caracas.

bamboo in respect to the pH value of the soil have come to my attention. This factor should be studied, however, since it may have a bearing on the development and maintenance of critical biological and chemical soil conditions.

Although experience with Oriental species indicates that they establish themselves and reach their mature stature with a speed that is in direct proportion to the fertility of the soil, no controlled experiments have been carried out to establish precise requirements of any species or the relative importance of different essential elements. There is some evidence that for the production of culms for certain industrial purposes a soil of moderate to poor fertility is to be preferred to a rich one. The suggested procedure here would be to select a site with a soil of moderate fertility and to hasten the progress of the young plants to their mature size and productivity by the application of manure or commercial fertilizers. After the root system is well established, heavy applications of well-rotted barnyard or stable manure, sodium nitrate, or a complete commercial fertilizer may be used to advantage, the time and method of application to be chosen so as to take the greatest advantage of seasonal distribution of rainfall. The organic matter may be simply applied to the surface of the soil as a mulch or may be dug in, while the chemical fertilizers should be mixed with the soil to get the best results.

Except in commercial production of edible shoots, or in special circumstances, the fertilization of bamboos of mature stature is not likely to be remunerative. In southern China, clump bamboos grown solely for their edible shoots

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A sheep ranch in the Paine region of Magallanes, Chile. Snow-capped peaks along the western coast are cut by fjords which resemble those of Norway.

Chile's Land of Magellan

Mountain scenery like that of the Alps or Rocky Mountains and fjords similar to those of Norway delight the traveler in Chile's Magallanes region, the southernmost tip of which is Cape Horn. Extensive sheep ranches produce the famous "punta wool" of trade.

by JAMES PARKER WILSON

The southern tip of Chile is pierced by the straits which bear the name of the leader of the first globe-circling expedition, Ferdinand Magellan. On either side of these straits are to be found large sheep ranches, the fine wool clip from which now finds its way into the United States as a result of wartime conditions.

Although one would expect the Magallanes region to be covered with snow at most times, such is not the case. True, there are many snow-capped mountains along the western frontiers of the region and these are cut by fjords which resemble those of Norway. Much of the mountainous section looks a great deal like that of Alpine Switzerland, but on the grassy plains of central and eastern Magallanes the rich natural grass and the strong winds and stern climate remind one more of northern Scotland. Throughout this southern territory about 2,800,000 sheep are maintained by a number of large sheep-raising ranch companies. The largest of these companies, maintaining properties which are larger than the Republic of Switzerland, celebrated its fiftieth anniversary last year.

In addition to native Chileans, the Magallanes region is populated principally by Scotch, Yugoslav, English, Irish, and other European nationalities. The capital and chief port, Punta Arenas or Sandy Point, is a truly cosmopolitan

The author was employed in Europe before the war by the Department of Agriculture. Since 1941 he has served as Agricultural Economist at the American Embassy in Santiago, Chile. Recently he was appointed by the Department of State to serve in Italy.

city with a population of approximately 30,000. This city and Valparaiso were especially prosperous during the days before the completion of the Panama Canal, when all shipping was obliged to take the longer route around the South American Continent.

The Sheep Industry

The principal breed of sheep in the region is the Corriedale, a breed which originated from crossing the Lincoln and the Merino. The wool of this sheep is highly prized for its lack of discoloration and is particularly sought after for use in knitting wools. In years preceding the war the wool clip of Magallanes was shipped largely to the British Isles. Classifiers from Bradford, England, arrived in the region each year to grade and classify the wool. This practice is still followed to a limited extent, but classifiers for the shearing season are increasingly difficult to obtain. As shipping difficulties increased after the outbreak of war, the decision was reached that the United States would assume responsibility for shipping and disposing of the Magallanes clip, thus freeing British vessels for use in the Empire trade routes. At the present time there are practically no European buyers, with the possible exception of Switzerland, which in 1942 took 500 tons of Magallanes wool. However, prior to 1941 Great Britain, Japan, Germany, China, the United States, Argentina, Mexico, and Brazil all purchased parts of the Magallanes clip. In 1944 almost the entire clip, about 20,000,000 pounds, was shipped to the United States, mostly to the Boston wool market.

In the trade the wool from the Magallanes region is commonly known as "punta wool," being named after the capital city of the area, Punta Arenas, which is located about one-third of the way inland from the Atlantic side of the continent. The Magallanes region is commonly known in Chile as part of the Austral region, which includes the provinces of Aysen and Magallanes. A portion of the province includes the large island of Tierra del Fuego, literally the "Land of Fire," the southern tip of which is *Cabo Horno* or Cape Horn. The chief ranches on the mainland of the Province of Magallanes are privately owned, but the land on the Island of Tierra del Fuego is known as fiscal or government land, and this property must be leased. Approximately 60 percent of the sheep of Chile are concentrated in the two provinces of Aysen and Magallanes.

Some of the famous Magallanes sheep. Approximately 60 percent of the sheep of Chile are concentrated in the 2 provinces of Aysen and Magallanes.

A bale of wool ready for shipment from the interior of Magallanes to the port of Natales or Punta Arenas, and thence, in all probability, to Boston.

Many millions of dollars have been invested by the sheep industry of Magallanes in land, buildings, shearing and other equipment and machinery, slaughter houses, cold storage plants, tallow-rendering plants, and even in ships. The sheep ranches are well managed, usually by Scotch, English, or Irish operators, and highest standards are maintained in breeding stock. Breeding rams are imported from New Zealand and the Shetland Islands every few years, and the care and attention given to all aspects of the sheep industry can hardly be surpassed in any other part of the world. The sheep feed wholly on the abundant natural grasses of the region.

Wool is probably Chile's most important agricultural export from the point of view of value of the product. Lamb and sheep skins also are exported in large quantities, and the sheep casings from Punta Arenas are purchased by Chicago and New York sausage-casing establishments. The exportable surplus of frozen mutton finds its way to the United Kingdom.

Remoteness of the Region

Because this region is so isolated and remote from many other parts of the world—it is the most southern tip of land of all the continents—even few Chileans have ever visited this part of their country. The President of Chile, Don Juan Antonio Rios M., recently paid an official visit, his first, to the region. The North American colony formerly consisted of one man, Ben Oberlander of Chicago, and his family, who lived there throughout the year to purchase sheep casings for a large Chicago sausage-casing

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Derris Grows in America

Rotenone in the form of insecticides can be of great value to farmers in protection of domestic animals and plants. Since Pearl Harbor, the Americas are growing increased quantities of derris roots to make rotenone.

by RUFUS H. MOORE

Ten years ago rotenone as a valuable aid to growers of fruits and vegetables had attracted little attention. By 1941 the value of this insect killer had become widely known and the imports of rotenone-producing roots into the United States alone were more than 7,997,400 pounds. Derris root from the Far East and lonchocarpus root from equatorial South America were competing almost equally on the United States market.

Because of the rapid increase in the use of rotenone, no appreciable reserve of roots had been stock-piled when the United States entered World War II, and any hope of building up a reserve was circumvented by the quick Japanese thrust into the Orient. The loss of British Malaya, the Netherlands East Indies, and the Philippines particularly reduced the importation of derris root. At the same time, the expansion of the food-production program increased the demand for rotenone insecticides far beyond the supplying power of South American lonchocarpus. Where was the desperately needed rotenone to come from?

Early Experiments

Fortunately some early experiments in the cultivation of derris closer home had been begun. When the Federal Experiment Station at Mayagüez, Puerto Rico, was reorganized in 1935 as a tropical outpost to study problems related to the economy of continental United States, research on insecticidal plants was one of its main assignments. The few plants of *Derris elliptica* (Roxb.) Benth. then available were propagated until enough were on hand to begin agronomic experiments. Later, derris was grown on a small commercial scale in Puerto Rico, but the relatively high daily wage made production costs prohibitive. Experimentation continued, however, and plans to introduce derris as a crop plant into tropical American countries with a lower wage scale were suddenly brought to a head by the Pearl Harbor incident.

The task of distributing propagating stock involved the teamwork of several governmental agencies. The Foreign Economic Administration borrowed the writer from the Office of Experiment Stations for two trips to locate sites favorable to derris culture. The Office of Foreign Agricultural Relations contributed much to the introduction of the new crop plant, especially in Ecuador and El Salvador. The Office of Experiment Stations provided the planting stock from the supply that had been growing at its Federal Experiment Station in Puerto Rico. Most of the labor to plant and care for nurseries and to prepare shipments was supplied by the Federal Work Project Administration and later by the Insular War Emergency Program. Bombers of the Armed Forces and other planes flew tons of living plants to continental America. Most of the arrangements for air transport were made by the Foreign Economic Administration, which also supplied all packing materials and bore the expense of delivering cargo to places

Trellised plants produce thick stems which are a source of superior cuttings. On the right, a 9-foot strip of the mat of trailing derris vines is being rolled up.

The sorting and arranging of stems with their basal ends together is done in the shade.

not served by the Air Transport Commands of the Armed Forces. Even if boat transportation had been available, sending derris stems and plants by steamer across the submarine-infested Caribbean would not have been advisable.

Preparation of Cutting Material

Part of the woody vines, eventually to be made into cuttings, were taken from plants supported on trellises. From these plants the leaves and stems were trimmed before the mature vines were cut into 3-foot shipping lengths. The rest came from plants that had been allowed to trail over the ground. Strips of the tangled mat of trailing vines were rolled up, moved to shade, and unrolled bottom side up to facilitate harvesting the thick stems which are always found in the lower part of the mat.

As rapidly as the 3-foot lengths of vines from either source accumulated they were taken to the packing shelter, thoroughly wetted, and covered to prevent drying. Here they were sorted according to thickness into extra large, large, medium, and small. Since small stems do not ship well, those were planted in local nurseries. Often it is not easy for one unfamiliar with derris to determine which end of the leafless cutting should be covered with soil; so, after the stems were classified as to size, they were arranged with their basal ends together. The stems were then counted into groups of convenient bundle size, superficial moisture was allowed to evaporate from them, and their ends were dipped in beeswax. Bundles were tied securely with soft cord and fumigated with hydrocyanic acid gas to kill the few scale insects that were occasionally found in them.

Sphagnum moss was used to conserve the freshness of the derris stems during transit. The moss was thoroughly wetted, the excess water squeezed out in an old book press, and the compressed cake loosened into a fluffy mass by whirling it in a box mounted on an axis much like one type of old-fashioned churn. Properly prepared, the moss was moist enough to insulate the stems against drying out but not wet enough to cause them to sprout or mold appreciably.

From the several methods of applying the moss that were tried the following one was adopted because it gave ample protection, required the least material and time, and minimized molding and premature sprouting. Near one end of three over-lapping strips of oiled paper was placed a rectangular loose layer of the prepared moss from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch deep and as long as the bundle. Upon this was laid the tied bundle of stems, and the paper and moss rolled firmly around it. With the paper kept under continuous tension until the first turn was finished, the moss was compressed into a uniform self-felting layer entirely covering the stems. Two or more complete turns of oiled paper were wrapped around each bundle and fastened with string. Two such bundles were wrapped together in two or more turns of brown paper and tied with rope to make a package ready for shipment.

Preparation of Plants

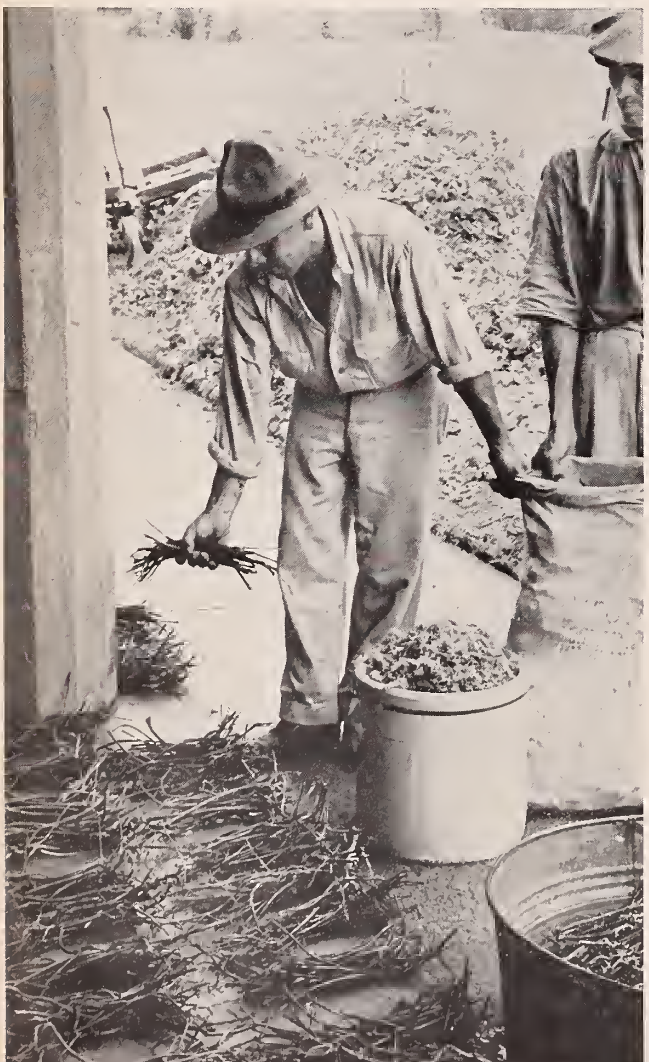
Stems too small for shipment were made into cuttings which were planted in nurseries and allowed to grow until they had become plants sturdy enough to be shipped. Field

Wrapping a bundle of extra-large stems in moss and oiled paper.

The author is a recognized authority on the production, cultivation, and harvesting of insecticidal crops and was for a number of years Associate Plant Physiologist at the Federal Experiment Station, Mayagüez, Puerto Rico. Recently he joined the staff of the Horticulture Department of the University of Nebraska.

experiments harvested when no orders were pending also added thousands of cuttings to the nurseries.

To prepare nursery stock for shipment required a set of operations quite different from those used on vines. Men with machetes cut most of the tangled vines and leaves from the nursery banks to speed up digging. As soon as they were dug, the plants were sent to the packing shelter, sprayed with a garden hose to loosen soil adhering to the roots, and washed clean in a tub of water. The stems, decapitated in the nursery by machetes, were cut back to 4-inch stumps and pruned free of leaves. After having been sorted into large- and small-size groups, the plants were counted and packed in burlap or cloth sacks. As the sacks were filled, a small amount of moist sphagnum was packed between the sack and the plants. The sacks were wrapped directly in two or more turns each of oiled and then brown paper and tied with rope.



Pressed and washed plants from nurseries are counted into groups of 25 to facilitate packing.

Since large consignments of stems or plants often were to be split up and assigned to several growers upon arrival at their destination, the variety and number of cuttings or plants were marked on each bundle, sack, and package. Instructions on the preparation of cuttings from the bundles of stems and on nursery and field plantings were distributed to prospective growers.

In order to prepare large shipments in a short time, mass-production methods had to be used. The procedure was split up into numerous standardized steps and the size of the crew assigned to each step was so regulated that bottlenecks were avoided. Particularly apt individuals soon became skilled in several tasks, and, like minutemen, stood ready to shift from one operation to another as the vagaries of weather or the pressure of shipping schedules demanded.

Varieties

The Sarawak Creeping variety of *Derris elliptica,* which constituted most of the planting stock, is a vigorous grower that has produced well over the 4 percent peacetime minimum of rotenone in air-dry roots. The highest quality Puerto Rican plants had 8.5 percent of crude rotenone, equivalent to 7.7 percent of pure rotenone, in roots with 6.3 percent of moisture. Total extractives, 21.9 percent of the air-dry root, bore a 3:1 ratio to pure rotenone, thus placing this strain of derris in a class that met the most exacting demands of importers during recent peacetime, when quality could be given due emphasis.

As much less of the Changi No. 3 variety was available for either experimentation or distribution, less is known of the quality of its roots. At Mayagüez it has produced 5.2 percent of pure rotenone, but it may yield higher-quality roots under more favorable conditions. With 12.5 percent of total extractives, the ratio between total extractives and pure rotenone is about 2.5:1. Changi No. 3 is more susceptible to drought than Sarawak Creeping.

Distribution

Derris should be grown in deep, friable, well-drained soils that are relatively flat and preferably less than 2,000 feet above sea level. Being a legume, derris normally has much of its nitrogen supplied by bacteria that form nodules on its roots. Although its requirements for potash and phosphates appear to be low, no one knows just how much of these fertilizer constituents the plant needs. In the experience of the writer, water is more likely to be a critical growth factor than soil fertility, the equivalent of 80 or more inches of well-distributed rainfall annually being required. Labor must be plentiful and cheap.

On the two survey trips that the writer made, several regions were found that filled most of the requirements, but the Pacific watershed of Guatemala scored highest on all points. Small patches of one variety of derris were already growing on several of the large *fincas* or farms. Owners

(Continued on page 16)

A Rain Forest Beside a Desert

Ecuador is a land of contrasts. There, beside a dusty, cactus-covered desert, one may find a rain forest where cinchona grows, shrouded in garúa mists.

by E. V. MILLER

We were traveling in a truck across the dry, dusty, cactus-covered flats of San Pablo, Jabita, and Colonche, in western Ecuador. In the blue hills ahead a climate so different from the present dust and heat that we might hope to see a rain forest and even cinchona trees seemed quite impossible. Ecuador enjoys, however, a reputation as a land of striking contrasts, and the climate of the Colonche region is typically Ecuadoran.

The people in the desert lowland villages of Colonche and Solonguillo are fully aware of and dependent upon the moist climate in the nearby northern hills. From those slopes come the bananas, toquilla fiber, tagua nuts, coffee, and other products which make subsistence in the desert possible. Equally important to life in these towns are the clear fresh waters of Río Jabita and Río de Las Pampas, which flow down from the hills and pass through Solonguillo and Colonche respectively.

Several months before, during a trip made to study land conditions for possible irrigation in the arid Santa Elena Peninsula, we had heard about cinchona trees growing in the forest above Solonguillo, near the summits, at an elevation of some 2 to 3 thousand feet. The present trip was undertaken to examine these native cinchona trees and their habitats, to find cacao trees free from witch broom disease, and to study the environments, including soils, where tagua and toquilla grow. Another purpose was to introduce from the Sierra, on a trial basis, the insecticidal plant pyrethrum to the desert Jabita valley. Here in this dry climate rapid growth might possibly be combined with freedom from the usual diseases which attack it in the humid tropics. The Coronel Brothers' hacienda at Jabita was the place chosen to make the trial, since its location on the banks of Río Jabita makes possible small-scale irrigation of trial plots.

In preparing the equipment for the trip, J. J. McDermott, U. S. Department of Agriculture biochemist, and I found that it grew and grew until we had some 200 pounds between us. Botanical presses, machetes, spades, insecticide bomb, 32-calibre pistols, altimeter, hand level, bed rolls, ponchos, hammocks, cameras, clothing, and food make two packs heavy even if the rations are concentrated.

The author is Soils Technologist for the Office of Foreign Agricultural Relations and is stationed in Ecuador on the staff of the Cooperative Experiment Station.

Hacienda Angela

The first stop out of the oil-field town of Ancón was Hacienda Angela, of the Anglo Ecuadoran Oil Company. This ranch receives distinctly more rainfall than Colonche village below. From that point on, Sr. C. Coronel, the hacienda manager for the Company, was a priceless companion because of his knowledge of the region and the people. He provided three *montañeros* (mountaineers) to wield machetes and to guide us in penetrating the cordillera.

The dry, dusty, cactus-covered flats of San Pablo, Jabita, and Colonche, with the blue hills of the Colonche Range in the distance.

Beginning at the elevation of this hacienda—400 feet—pastures and crops such as bananas and coffee grow well because of the *garúa* season which cuts right through a long period without normal rains. The annual cycle of seasons along the Colonche range is: Dry weather in December and January; heavy rains with plenty of sunshine in February, March, and April; a dry spell in late April and May; and the long season of mists and light rains from June to November, which in Ecuador is called *garúa.* This weather phenomenon is the most interesting factor in environment for plant growth which one encounters in that country. Not only the Colonche Hills but the outlying regions of the western Andean slope experience this out-of-season humidity. The total gain in precipitation as measured by a standard rain gage is practically nil, but the effect on plant growth is startling. The marked effect on soil moisture, also, made by this continuous mist in the upper portions of the Colonche Hills is plainly seen in the increasing flow of Río Jabita in the summer months after the May drought.

In 1944 the dry spell severely lowered the river from May until the middle of June, but the *garúa* mists restored the moisture of the watershed and the level of the river.

Hacienda Angela, which stretches from an elevation of 400 to 800 feet on the slopes of the range, extends over a marked climatic change. At the lower edge the trees are small and transitional from the dry-region bush, dominated by barbasco, which occurs around Febro Scordero. At the upper levels there is a heavy forest, including several timber types.

The soils are heavy clays, some having a black surface horizon and others brownish yellow. The color is related to the type of shale from which the soil is derived, however, rather than to the difference in climate. Experience at Hacienda Angela shows the superiority of the brownish soil type for cultivated crops such as bananas, cacao, and coffee. Corn also grows better on the light-colored soils. Pastures were beautiful, however, irrespective of the soil type. Fine broad rolling areas of guinea grass (*paga chilena* in Spanish), gramalote, and Pará grass (Janeiro) covered several hundred acres. The pastures were heavily infested with ticks, but this problem was solved in the cattle-production program by the regular dipping of the animals in a bath of arsenicals.

At the lower end of the hacienda thrives the drought-resistant cari palm, from which come the tagua nuts of trade. There, too, young cacao 3 and 4 years old, growing near the entrance, was just beginning to fruit, in May 1944. No disease was evident in the planting, and the cacao was not being attacked by the large population of leaf-cutter ants. On the other hand, orange seedlings were completely denuded by the pests.

On the following day we examined on old cacao orchard in the upper part of the hacienda at an 800-foot elevation. These trees, from which seed had been collected for the new disease-free plantings, were found to be heavily infested with both of Ecuador's dreaded cacao diseases—pod rot and witch broom. The progress of the young orchard in the drier portion of the hacienda will be interesting to observe in the future with regard to disease resistance in that climate.

During the evening, in preparation for the night, the interior of the frame house at Angela was sprayed with a pyrethrum insecticide bomb. Within 5 minutes a buzzing sound could be heard all around the room, and a fine collection of insects began to make crazy circles on the floor. Soon the collection of dead insects included huge cockroaches and spiders, ants, moths, and two kinds of black beetles. No mosquitoes were found, although the spraying had been done for mosquitoes. The manager of the hacienda was more than impressed with the pyrethrum performance, especially in its extreme effectiveness against leaf-cutter ants. The Freon bomb will, unquestionably, have great usefulness in fighting this tropical pest after the war, when it becomes available for agricultural purposes.

The meat of the *guanta* is white and delicious in a rice stew.

The Toquilla Country

Above the hacienda, at an elevation of 1000 feet was a large flat bench land, in which the clay soils were noticeably gray, the color produced by the poor drainage. In this area we passed through a pure stand of many acres of bushy toquilla, palm-like shrubs that grow from 6 to 10 feet high. At one place in the *toquillal* a whole family of workers were harvesting toquilla fiber to be carried down to the village of Febro Scordero, where the straw is prepared for the making of the famous Ecuadoran straw hats. The harvest consisted of young cane-like shoots, as yet unopened, from which the fan-shaped leaf would later have emerged. The still-compressed fan is enclosed in a green sheath which must be stripped off to leave the tough white fiber. Large bundles of the fiber canes are carried donkey-back or man-back to the village, where the white heart is further stripped, separated, and boiled in a 5-gallon gasoline can. In Febro Scordero the houses all stand high upon stilts, and hanging down underneath are innumerable strings of the white fiber suspended there to dry. From this section northward to Manabí Province the straw-hat industry furnishes the main occupation of the people. The toquilla palm appears to thrive in the *garúa* climate and shale soils of the Colonche Hills.

Cari palms grow in great numbers, also, all the way from the drier transitional belt at Hacienda Angela to the edge of the wet tree-fern forests on the crest of the cordil-

lera, but the tagua or vegetable ivory nuts that grow on them are exploited on a much smaller scale than toquilla, because of the limited demand for them.

The Rain Forest

Our search for cinchona was unrewarded even though we penetrated to the humid plateau at an elevation of 2,600 feet. In the wet, mossy, fern-covered rain forest, however, there was a considerable population of other *Rubiaceae*. One tree species of ladenbergia, unfamiliar to us but found here in great numbers, had bitter bark and was in fruit in May.

During the 2 days of encampment at the top of the cordillera we had excellent meat to eat as Manuel, the old woodsman who served as guide, was a crack shot with his old flintlock. Even while camp was being pitched, which consisted of stringing hammocks covered with crude leaf shelters to shed the *garúa,* a shot was heard. Manuel had expended his first rifle load and returned triumphantly with a good-sized guanta. This animal is like an oversized Minnesota gopher, with meat that is white and delicious in a rice stew. Another good meal was furnished by a wild turkey.

After the failure to find cinchona we went back to Solonguillo and with a new guide made a fresh start into the hills. This time the route followed the Río Jabita canyon northward, where the valley became gradually more and more heavily vegetated. Sections of green, water-filled bamboo nodes were cut for drinking purposes. Then for an hour the mules climbed up the steep path, until the mule trail ended in a patch of toquilla, and from there all travel was done on foot.

Large bundles of toquilla-fiber canes are carried on the backs of men or donkeys to the village, where the straw is used in making the famous Ecuadoran straw hats.

Cinchona at Last

At an elevation of 1,900 feet the cinchona (*pubescens*) trees were located. The forest was somewhat less dense in the cinchona belt than on the ridge northeast of Angela, but the trees were large. They were growing on extremely porous angular gravel soil, quite different from the uniformly heavy clays of the other sections of these mountains. Old branches, apparently discarded at the time when a tree was harvested years ago, had taken root in the dark-colored topsoil and provided a good source of small rooted plants to carry out for planting under conditions of comparison with other cinchona types. Unfortunately, no seed was found on these trees. All available shoots were planted in a topsoil bed for future reference, and bark and soil samples, botanical specimens, and several small plants were collected.

Although this second journey did not penetrate into the tree-fern forest of the upper ridges, it was, nevertheless, more striking than the first one in the swift change of climate. During a 3-hour walk from the village we had passed from cactus desert through the barbasco zone, through the tagua and toquilla zone, and into the heavy timber where the cinchona occurs.

The Cordillera Colonche is largely unexploited and uncultivated. This is probably due to the wet climate which, though it makes possible the heavy plant growth, is an extremely disagreeable climate in which to live. After a night in the *garúas* of the Colonche Hills one can appreciate the little desert villages of Solonguillo, Colonche, and Febro Scordero, where one can usually keep warm and dry.

BAMBOO CULTURE IN THE AMERICAS

(Continued from page 7)

are given heavy applications of diluted urine, but never any other fertilizer, according to our present information.

Western Hemisphere Uses of Bamboo

The use of bamboo in nearly every aspect of daily life in certain parts of the Orient is well known. While it probably never will attain equal importance in the life of Western peoples, bamboo has demonstrated impressive potentialities for enriching the domestic economy of large areas of the Americas.

Paper is being made today in the Western Hemisphere from bamboo pulp on a commercial scale. The techniques for the preparation of cellulose pulp have already been perfected to a high degree, and it is quite possible that, when adequate supplies of raw material are made economically accessible, bamboo pulp may become an important factor in the world market. Experiments are under way to test the suitability of bamboo cellulose for rayon.

In certain areas of Latin America, bamboo has long been used extensively in various forms of construction. Elsewhere it is much used in packing and shipping, especially as supports and struts in bales of fibers and similar bulky material. Enormous quantities of bamboo poles are used in the "shoring up" of cargoes in the ocean-going freight ships of all nations that ply the seven seas outbound from Oriental ports. Related uses are floating landing stages, rafts, floats for rafting nonfloating logs, cables for towing vessels, and the masts, staving-off poles, and punting poles used on small craft. In the Orient, baskets of finely woven bamboo lined with tough bark paper are used for shipping tung oil.

The culms are proving valuable in many devices for the farm, the household, and in sports. Living hedges are used for screens in landscaping, for windbreaks, for marking boundary lines, for stopping erosion, and for revetments. The foliage has been used as fresh forage for livestock, and the shoots as human food.

Western technological ingenuity has produced the hexagonal, or rarer quadrangular, composite construction, and the impregnation of bamboo with Bakelite, for fishing rods and ski poles. By this process the wood is stiffened, is stabilized to an important degree with respect to the absorption and loss of water, apparently is rendered immune to the attacks of insects, and takes a beautiful finish. Indeed, bamboo will, in all probability, find its most spectacular usefulness in the Western Hemisphere, not primarily through the imitation of Oriental ingenuity, but by means of new techniques developed in the West.

CHILE'S LAND OF MAGELLAN

(Continued from page 9)

house. Shortly before the entrance of the United States into the present war a United States Vice Consulate was established in Punta Arenas and now numerous other North Americans are there engaged in producing furbearing animals and prospecting for oil. The sheep producers in the southern region hope that even after the war they will be able to keep at least a part of their wool-market outlets in the United States, because previous to the war almost the entire clip was purchased by one large Bradford and London wool-auction firm and there was little opportunity to bargain for the most favorable prices.

One reason for the isolation of the Magallanes region is that no roads or railroad lines reach beyond Central Chile, which extends down to the port of Puerto Montt. Neither do air lines extend to the Magallanes region. The traveler must travel by water from Valparaiso or Puerto Montt on the Pacific side to Punta Arenas, or he may go by auto or airplane down the Argentine side of the Andes. The Chilean Government has not found the establishment of an air line along its western coast between Puerto Montt and Punta Arenas feasible because of the difficult weather conditions and terrain. The region is noted for its heavy rainfall, its mountains, its many islands, fjords, and canals. Even the airplanes flying down the Atlantic side of the continent to the Magallanes region encounter such strong winds throughout the Patagonian region and along the Straits of Magellan that they must be met by ground crews carrying long rake-like poles which they fasten on the wings and fusilage to keep the ships from blowing out of control.

Attractions for Future Development

Although sheep raising is the largest and most important industry, many possibilities exist for developing the Magallanes region in the future both as a center of tourist attraction and for new industries. The mountain scenery is much like that of the Alps and Rockies. The trip by steamer from Puerto Montt is made interesting by thousands of little islands, jagged mountains, fjords, and glaciers. There are primitive Indian tribes and unusual flora and fauna, especially ostriches and guanacos. At the present time there is also considerable interest in a new fur industry and in the possibility of establishing a feather industry. The enormous flocks of birds which migrate to this southern region every year are a great nuisance to the sheep men because they eat quantities of grass that otherwise would be consumed by the sheep.

DERRIS GROWS IN AMERICA

(Continued from page 12)

of these estates—which characterize the rural economy of Guatemala—had each purchased a few plants from the stock introduced by the Guatemalan Government in 1940. Despite some neglect, the plantings at lower elevations had not been choked out by weed competition, and roots taken from them were found to be of commercial quality.

Soil and climatic conditions in Southern Mexico and El Salvador are similar to those in Guatemala. These three countries are linked by their common source of latent agricultural wealth—volcanic ranges. Dust, cinders, and lava spewed from craters have weathered over large areas into rich, mellow soil of great depth. Mountain ranges are high enough to intercept moisture-laden winds and to be the source of a multitude of streams that provide cheap irrigation in the dry season. El Salvador, on the whole, is less mountainous and hence drier than Guatemala.

During the 18 months following January 1, 1942, some 2,064,230 derris cuttings and plants were distributed to 18 Latin American countries, Hawaii, Florida, and Egypt, the largest number—575,354—going to Guatemala. Ecuador received the second-largest number—529,301—and El Salvador, Honduras, Colombia, and Mexico each received more than 150,000. Haiti, which had started to raise derris long before Pearl Harbor, is expanding its planting program.

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ALONG THE *Agricultural Front*

▲ Many Attend Inauguration of Agricultural School

More than 500 persons attended the inauguration ceremonies last Columbus Day of the Pan American School of Agriculture which lies in the beautiful Yeguare Valley in the pine-clad uplands of the interior of Honduras. The school was established by the United Fruit Company and has for its purpose the teaching of good citizenship and technical agriculture to a selected group of students from Central and South America and the Caribbean area. A total of 122 students from 11 different countries were enrolled in the school this fall and this number is expected to be increased to 160 by the next academic year.

Among those who spoke at the inauguration ceremonies were Dr. Wilson Popenoe, Dean of the School; Dr. Manuel Galvez, Minister of War of the Republic of Honduras; Medardo Zuniga, Honduran Minister of Development, Public Works and Agriculture; Dr. David Fairchild, North American botanist and founder of the Fairchild Tropical Gardens; and Mrs. Doris Zemurray Stone and Walter E. Turnbull, of the Board of Trustees of the School. In addition, an address in Spanish, especially prepared for the occasion by Vice President Wallace, was presented over the loud speaker from a record delivered for that purpose from Washington.

Others who attended the ceremony included Abraham Williams, Vice President of Honduras; H. D. Erwin, Ambassador from the United States to Honduras; and Ministers from many of the Central American countries.

▲ Black Acacia Plantings Show Progress in Brazil

While the production of black acacia, the bark of which is used in the tanning of skins, in Brazil is still in the experimental stage, and several years will probably be required before important quantities can be placed on the market, local tanneries in Rio de Janeiro report that the commercial plantings made several years ago in Rio Grande do Sul and the State of Rio de Janeiro have been quite successful. Only in the State of Rio do Sul, however, have plantings reached the stage where large quantities of tanbark can be marketed. Practically all of this is being used in other parts of Brazil and only a small amount is offered for export.

▲ Babassú Factory Opens in Kelru, Brazil

A new babassú processing plant was recently opened at Kelru in the State of Maranhão, Brazil. Brazilian industrial leaders believe that the new plant will be an important step in the development of the vegetable oil industry in that country.

The plant is owned by Industries Babassú, Ltda., and is located about 50 miles from the port of São Luiz. The factory has facilities for the mechanical cracking of whole babassú nuts and the automatic separation of the husk, mesocarp, endocarp, and kernels. The kernels are taken directly to the expellers, where the babassú oil is extracted. When the plant is in full operation it is expected that various residue products will be manufactured, including babassú, coke, and acetic acid.

THE ORINOCO

(Continued from back cover)

of vast mineral and agricultural wealth. Another observer, however, points out that the lush tropical forests of this area are not an infallible sign of soil fertility, and he regards the almost complete absence of animal life as indicative of unfavorable conditions.

The Llanos

The llanos, north of the Orinoco, are great savannas or grass-covered plains about 600 miles long and 200 miles wide. Elevation seldom exceeds 800 feet and only a few areas of low hills and sand dunes break their smooth surface from the Guaviare to the Atlantic. These plains furnish pasture for most of Venezuela's cattle. Since colonial times, the cattle industry has been a basic part of the country's economic structure. Other industries have flourished for a time and then diminished, but the cattle industry has remained more or less stable. This immense grazing territory, resembling Texas and Kansas, is subject to floods during the rainy season. Cattle are driven by the waters to the low hills, which are soon eaten bare. When the dry season advances, the tall savanna grass becomes hard and inedible. Then the plainsmen must drive their herds farther south to the wet spots near the Orinoco or north to the Valencia Basin, where they are fattened for market. From the city of Valencia in that Basin a new highway provides quick and easy transportation to Caracas for meat and other products. Ciudad Bolívar, a city of some 25,000 inhabitants, is the commercial center of the llanos. Cattle from the southern section of the region near the Orinoco are transported by boat from this point to Trinidad, Martinique, and other nearby countries.

Northern Highlands

Inside the wide arc that is delimited on the west and north by the Continental Divide and on the east by the northern boundaries of the delta is the most highly developed and densely settled area of the basin. Venezuela's people are concentrated in the northern highlands and they spill down the southern slopes into the foothills. Here are fertile valleys and gently rolling hills which are extensively cultivated. The principal crops are corn, potatoes, yams, yuca, and beans for local food consumption, as well as coffee and cacao for export. Coffee grows largely on the lower mountainsides to the west, whereas the basin's cacao production is in the delta region to the east. Tobacco, sugarcane, a variety of citrus fruits, and small amounts of rice are also grown. Some livestock is raised and dairying is carried on near the larger towns.

The Government is taking increasing interest in improvement of the farming methods and livestock breeding of the Orinoco Basin and in the education of the people in matters of diet and sanitation. Development of the agricultural opportunities of the Orinoco Basin may help food-importing Venezuela to grow much more of its needs for subsistence.

The South American Handbook, by Howell Davies (Ed.). 798 pp. Trade and Travel Publications, Ltd. (Agents in the United States of America, The H. W. Wilson Company), London; 1944. This is the 21st edition of a handbook on Western Hemisphere countries, exclusive of the Dominican Republic and Haiti, with an introductory section covering information useful to people undertaking a trip from England to South America. Under each country section, information is included on such things as cities and towns, pleasure resorts, physical features, climate, characteristics of provinces, government, resources, finances, industrial development, currencies, weights, measurements, calendar of historical events, and miscellaneous travel information.

A Modern Conquistador in South America, by Clarence E. Altenburg. 167 pp. The Christopher Publishing House, Boston; 1944. This book is a collection of personal letters from the author to his wife, describing his experiences in cities and jungle regions of Latin America, with many types of people.

Orientaciones a los cañeros mexicanos, by José Ch. Ramírez. 68 pp. Unión de Productores de Caña de Azúcar de la R. M., Mexico, D. F.; 1944. This little book gives advice to the sugarcane growers of Mexico, under the topics: Methods of cultivating cane, varieties, irrigation, drainage, function of the nutritive elements of sugarcane, fertilizing, the sugarcane moth borer, and bagasse as a fertilizer.

The Problem of Inter-American Organization, by M. Margaret Ball. 117 pp. Stanford University Press, Stanford University, California; 1944. This is one of the series of "Stanford Books in World Politics." The author discusses the nature of inter-American organization, its organs and functions; economic problems and special conferences in the field of agriculture; and the future development of the 45 or so agencies of inter-American organization.

EDITOR'S NOTE.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

DERRIS GROWS IN AMERICA

(Continued from page 16)

The fact that more than 2 million cuttings and plants have been distributed to growers scattered throughout tropical and subtropical America does not mean that 2 million plants are growing from this stock. Some derris cuttings do not reach their destination alive. Others may not survive the turn of circumstance. For example, modern ingenuity will have to outwit the tall grasses that offer serious competition to derris in certain Central American countries, grasses that some people believe quietly smothered the Mayan civilization of centuries past. The major part of the planting stock, however, has been concentrated in the more favored regions in Latin America.

The Future of Derris

Derris fits neatly into Hemispheric economy. The United States farmer needs the product of this plant, which cannot be grown economically even in the mild winters of most of the Southern States but which prospers in sections of the Americas where the only seasons are the wet and the dry. Derris is as necessary as it is complementary to the agricultural economy of the United States. To the Latin American farmer it can be much more than a complementary crop, noncompetitive to the products of United States farmers; the tropical grower can follow the practice of Chinese gardeners by using infusions of fresh roots to rid his crops of insect pests.

Ordinarily plants are allowed to grow 2 years in the field before their roots are harvested. Markets for most of the first crop are assured by contracts which the Foreign Economic Administration made with the growers to whom it distributed planting stock. The experience of growing the first crop should make for lowered production costs of the second and succeeding crops. To provide for continuity of the program and the consolidation of gains, men are sent to the Federal Experiment Station in Puerto Rico to become familiar with derris problems before they are assigned to Latin America. Central and South America can produce enough rotenone to supply both their local needs and the United States market. Indications are that derris has come to America to stay and that any future world upheaval will not find the Pacific Ocean separating us from one of our major sources of rotenone.

AGRICULTURE IN THE AMERICAS — O. R. CARRINGTON, EDITOR

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Gifts of the Americas

THE AVOCADO

by CONSTANCE H. FARNWORTH

The avocado started its travels around the world from the mainland of tropical America. There, in its native home, the Indians have been cultivating it since ancient times.

As far as is known, the first written record of its existence was in Gonzalo Hernández de Oviedo's report to Charles V of Spain in which he described the fruit found in Colombia as "like a pear in shape but nothing else." He called it "peral" but it is now better known as alligator pear, midshipman's butter, and l'avocatier. The name avocado, probably a corruption of the Spanish *ahuacate* or *aguacate*, has been officially adopted by the California Avocado Association and is used in publications by the U. S. Department of Agriculture.

The avocado was first reported to be found in large quantities at Santa Marta, Colombia, in 1819. It was introduced into Florida in 1853 and aroused commercial interest about 1910. The fruit has always been extremely popular with the Central and South Americans as a staple food and is gaining favor in North America as a salad fruit. Its soft, butter-like flesh has a peculiar nutty flavor which many people find delicious when served with condiments as a salad, though others call it oily and tasteless. Oil is sometimes extracted from the fruit, but not much use has been made of this because of the limited supply and resulting high prices.

The Indians of Central and South America like the avocado in its natural state. With little formality, they break the fruit in half, season the flesh with salt, and, with some tortillas and a cup of coffee, have what they consider a good meal. But the fruit may be served in many ways. It gives a pleasant flavor to soup if added at the time of serving. A mixture of avocado pulp, onions, pepper, salt, and lemon juice makes a delicious salad called *guacamole* which is popular in Cuba. Or, the fruit may be used as a dessert by making a tasty ice cream as the Brazilians do.

The avocado grows well on the red clays of Cuba and Guatemala, the volcanic loams of Guatemala and Mexico, the sandy lands of southern Florida, and the soils derived from granite in California. In Mexico, Central America, and the West Indies it is a common dooryard fruit, thriving well with little care and yielding an abundance of fruit. The avocado trees are rapid-growing evergreens with some claim to beauty, varying from 30 to 60 feet in height. The probable life of the tree is estimated at about 80 years. A single tree produces generally from 50 to 500 avocados a year, although some have been known to produce 3,000 in a single season.

The avocado belongs to the genus *Persea,* a member of the family *Lauraceae,* and is related to the cinnamon tree, camphor, and sassafras. Three varieties are cultivated—the Guatemalan, Mexican, and West Indian. The Guatemalan type usually has a thick, warty skin from 1/16 to 1/4 inch thick, somewhat like the shell of a nut. There is a line between the flesh and the skin so the edible part, or flesh, can easily be scooped from the shell. The fruit weighs from 4 ounces to 1 pound and is a deeper color than the others, often reaching a deep bronze red. This Guatemalan type has been introduced into California, Florida, Hawaii, Cuba, and Puerto Rico. The hardiest variety is the Mexican, which is cultivated in the highlands of central and northern Mexico. The fruit is small, weighing from 3 to 12 ounces. The skin is thin, usually smooth and glassy, and varies in color from green to a deep purple. The Mexican type is now cultivated in Chile and many regions of the Mediterranean. The avocado production in Mexico in 1932 was about 38,600 short tons and increased to about 64,000 in 1941. The West Indian type weighs from 4 or 5 ounces to 3 pounds, is yellow green to maroon in color, and has a thin skin rarely more than 1/16 of an inch thick. It grows as far north as California and as far south as Central Chile.

Avocados may be found on the United States market every month of the year, being shipped in from Mexico, Hawaii, and the West Indies, with an increasing amount of superior-quality fruit coming from Florida and California.

Avocados rank high in food value. A pound of the flesh represents an average of 1,000 calories. It has a higher fat content than any other fruits eaten in a fresh state and outranks them all in protein content. The vitamins from A to E, with the exception of C, are found in liberal quantities. This unusual salad fruit is one of the most important sources of food which the Tropics offer the world today.

THE ORINOCO RIVER BASIN—VENEZUELA

by **Mary S. Coiner**

Columbus, exploring the Gulf of Paria on the west coast of Venezuela in 1498, was probably the discoverer of the third-largest river system of South America. But while noting the fresh waters of the Gulf he failed to seek their source. Ordaz in 1531-32 was the first of the conquerors to explore any part of the river.

Most of the land area of Venezuela is included in the Orinoco Basin. The basin extends from the Guiana Highlands in southern Venezuela across the vast lowland plains almost to the crest of the Andean Highlands in the north and reaches out to drain the eastern llanos of Colombia. It stretches toward the Atlantic through the delta, which is composed of some 700 square miles of swamps and small islands covered with dense vegetation.

The Río Orinoco itself is about 1,600 miles long from its source to the sea. Together with its tributaries it affords some 4,000 miles of navigable waterways and provides the only means of transportation for much of the interior of Venezuela and Colombia. It rises in the Sierra Parima on the Venezuelan-Brazilian boundary and flows in a northerly direction for almost half its length. It turns directly eastward at the point of its junction with the 745-mile-long Apure. Near the head waters of the Orinoco in the region of Esmeraldas is a stretch of 220 miles known as the Casiquiare Canal. This natural canal is unique in that it serves as a link joining the great Amazon system with that of the Orinoco.

Except for a few isolated hills north of the lower river, the Orinoco forms the dividing line between the llanos to the north and the highlands to the south, which are the source of several important tributaries. The largest of these, the Ventauri, joins the Orinoco about 90 miles above the mouth of the Guaviare. The principal rivers of the llanos are fed by torrential mountain streams rising in the eastern ranges of the Cordillera Oriental of Colombia. The headwaters of the Guaviare and the Meta lie in the high basins of these ranges.

Except for the northern fringe of the basin, this extensive area is sparsely populated. It covers all temperature belts of Venezuela: The tropical, from sea level to about 2,400 feet, includes the llanos, where the heat is consistent and extreme; the foothills and lower mountains with a subtropical climate were once covered with abundant forests which have now been substantially replaced by coffee trees; in the Andean States of Mérida and Trujillo are the temperate belt, from 6,000 to 9,000 feet, and the páramos or cold lands, from 9,000 to 14,000 feet. The páramo is of little importance agriculturally.

Even though the basin contains oil, gold, and diamonds, and forest resources such as hardwoods, tonka beans, and rubber, agriculture and livestock predominate. The northern part of the basin, which is in the agricultural section of the northern highlands, and the llanos, with their livestock industry, are the important agricultural centers. Much of the area is undeveloped and its characteristics differ widely from region to region.

The Guiana Highlands

South and east of the Orinoco lie the Guiana Highlands, approximately 150,000 square miles of plains and forested mountains. A region potentially productive in mineral and forest resources, it has never been fully explored and its rich natural resources are as yet undeveloped. The many river valleys produce small crops of corn, plantains, tobacco, sugarcane, certain fruits, and some rice. Several varieties of hardwoods and dyewoods, as well as balata, rubber, tonka beans, and chicle, flourish in the tropical forests. Many of these products are carried to the seaports by the Orinoco and its tributaries. In addition, there are products less important in trade, such as quina, kapok, coconuts, and vegetable waxes. The known mineral wealth of the Guiana Highlands consists of gold, iron ore, and diamonds. The mines are worked only on a small scale, although in 1939 diamond mining in the Caroni-Paragua region reached 80,000 carats.

The Upper Orinoco Valley

Little is known about the upper Orinoco Valley. The suggestion has been made that development of this area by modern methods plus knowledge gained from recent surveys and expeditions would open up a land

(Continued on page 17)

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NAMES & NEWS

Trainee Receives Appointment

Señorita Ofelia Hooper, a student last year in the trainee program of the Bureau of Agricultural Economics, was recently made acting head of the Section of Agricultural Economics, Department of Agriculture of Panama.

●

Visitor From Brazil

Senhor Roberto Meirelles Miranda, Assistant Professor of the National School of Agronomy, Rural University, Rio de Janeiro, recently arrived in this country as a guest of the Departments of Agriculture and of State. He will spend 6 months in the United States and will take courses in various agricultural subjects.

●

To Make Soil Survey

Eilif V. Miller, Soils Technologist for the Office of Foreign Agricultural Relations, will be detailed temporarily in the near future from Ecuador to Peru, where he will assist in making a survey of soil areas suitable for planting and cultivation of various complementary tropical crops. The survey will be under the direction of Dr. Robert L. Pendleton, recently detailed to Peru by the Office of Foreign Agricultural Relations.

●

Brazilian to Study Agricultural Activities

Dr. Paulo A. Goncalves, of the Rice and Meat Institutes, Rio Grande do Sul, Brazil, will spend some months investigating the techniques of rice culture in Louisiana and Texas, and the production of cattle and hogs under feed-lot conditions in Iowa, Ohio, and Illinois. Dr. Goncalves is particularly interested in Brahman and Hereford cattle and is engaged in studying areas in this country which have range conditions similar to those of Rio Grande do Sul.

To Study Extension Methods

Señor Oscar Pascual Chiesa, Agricultural Engineer, Escuela de Agricultura, Cordoba, Argentina, has been commissioned by his Government to study Extension Service methods in the United States.

●

Brazilian Agronomist Here

Dr. Octavio Domingues, Professor of Agronomy, of the Agricultural College, Rural University of Rio de Janeiro, is visiting the United States as a guest of the Office of the Coordinator of Inter-American Affairs. Dr. Domingues specializes in animal breeding.

●

To Study Fruits and Vegetables

Señor Homero José Anastessiu, of the Faculty of Agronomy, University of Chile, has been awarded a fellowship to this country by the Pedro Aguirro Cerda Foundation to carry out certain studies on the fruit and vegetable industry. Señor Anastessiu will investigate also the preservation of oranges, lemons, quinces, papayas, carrots, and tomatoes.

●

Receives Fellowship

Señor Manuel Francesco de Mendiburu, Technical Adviser in Warehouse and Storage for the Peruvian Ministry of Agriculture, has been awarded a fellowship by the Institute of Inter-American Affairs for study in the United States. Señor Mendiburu will spend 4 months investigating methods of storing and preserving human food in a dry climate, with especial emphasis on sweetpotatoes and rice.

●

To Aid in Food Production

Señor Luis Gattoni, of Santiago, Chile, who is employed by the Food Supply Division of the Institute of Inter-American Affairs, is visiting various manufacturers of agricultural implements and seed production centers in Florida, Louisiana, and Maryland. Señor Gattoni spent considerable time at the Beltsville Research Center gathering information which will be helpful in the food production program in Ecuador, where he will be working for some time.

Agriculture IN THE *Americas*

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Amazonian Jute for Coffee Bags

The bags in which your Brazilian coffee is shipped may be made of jute grown in the same country. This is the story of jute and its development in Brazil.

by CECILLE M. PROTZMAN

One of the most interesting developments that has taken place in Brazil in recent years is the increase in the production of jute fiber to meet the demand for bags and burlap necessary for the marketing of coffee and other agricultural products. Originally Brazil imported most of its jute from India but importation of the fiber has been curtailed by the war. As a result Brazil has turned to the use of substitute fibers and to the cultivation of jute at home. The Brazilians have been so successful in cultivating the fiber that substantial amounts are being produced and increasing quantities of jute products are being exported to the United States.

Both the plant and fiber are designated as *juta* in Portuguese, *yute* in Spanish, and *jute* in French, German, and English. There are two species: The *Corchorus capsularis,* or round-pod jute, with small brown seeds, and the *Corchorus olitorius,* or long-pod jute, with long, small, bluish-colored seeds. Both species are annuals, and they look so much alike that it is difficult to distinguish between them except by the pods and seeds. One is usually grown in river valleys, the other on higher ground. Both require a fertile soil and a warm, wet climate.

History of Brazil's Jute

Attempts have been made from time to time to establish jute cultivation in Brazil. Probably the earliest ones occurred soon after the turn of the century. The São Paulo State Department of Agriculture imported small quantities of seed for a plot south of Santos near the coast, at about the same time that a private citizen tried cultivation on another plot nearby. Neither project was fully successful.

Some time later a private company was organized for the establishment of a jute industry. Seed again was imported.

Home of native worker near Obidos. At flood stage the river often approaches the walls of the hut.

Jute is hung on racks to dry out.

One planting was made in the western part of the State and another a little north of the city of São Paulo. These experiments, placed under the supervision of a specialist from India, proved fairly successful and were continued for about 7 years.

Soon after the abandonment of the experiments in São Paulo two new projects were begun in the Amazon Valley, where soil and climatic conditions were quite different from those farther south. An agricultural school had been established by the Japanese near Parintins in the eastern part of the State of Amazonas and work done by personnel of the school carried the jute experiments to success in the Amazon Valley. They brought in seed from São Paulo, Japan, and finally from India. Yields were somewhat below expectations and the plants averaged a little less than 5 feet in height, but when samples of fiber from the Indian seed were sent to Japan for testing purposes results indicated that Brazilian jute had approximately the same qualities as that grown in India. School authorities, encouraged by the report, sent Dr. Issáku Kino to India to study methods of culture in that land where the industry was most successful. They then placed him in charge of students and agricultural colonists who attempted extended cultivation.

Success, at that time, would have been no nearer than before had not a man by the name of Ryota Oyama noticed two stalks which appeared outstanding in size and character. These stalks were carefully tended and grew to be more than 13 feet tall. Even special care could not prevent high water from destroying one of the precious plants, but seed from the other one was planted that fall. Two years later enough seed had been produced from the strain to plant 37½ acres. The new variety required nearly 4 months to mature, or about twice as long as the plants grown in previous experiments, but yield was good. In the spring of 1937 the first 10 tons of Brazilian-grown jute was sold in Belém, and a new industry had become established in Brazil.

Recent Developments

Constant experimentation has produced fiber that has been marketed under such varying names as Oyama, Parintins, Santarém, Amazon, and Brazilian. Most of the jute grown in India and all that cultivated in Brazil is the *Corchorus capularis* or round-pod jute. The Brazilian varieties have developed from seed brought in from India.

The Government granted special concessions to the Japanese growers, who expanded their Parintins plantings and established a second important center at Santarém. When Brazil entered the war, the Japanese organization was taken over by Government authorities together with most of the lands owned by individual Japanese. Brazilian capital is now invested in the industry. Prices are favorable because of wartime shortages, but labor problems have vexed the growers. A plantation started near Rio de Janeiro was abandoned after only 2 years. Cultivation in Espirito Santo is progressing well, and about 875,000 pounds of fiber may be realized from the 1944 crop.

The most important area of jute production in Brazil is a narrow strip of alluvial flood lands extending for many miles along the banks of the Amazon River and several of its tributaries from the Colombian boundary to the Atlantic Ocean. The greatest concentration of plantations is around Santarém, Jurity, Obidos, Parintins, and Manaus. The total area is about 16,000 acres. A field can be planted to jute for 2 or 3 successive years; then it is abandoned to the jungle, and new land is cleared. Such procedure will be necessary until a satisfactory system of crop rotation can be worked out.

Cultivation of Jute

Cultivation and preparation of the fiber require an abundant supply of labor. In India all the work is done by hand and for each square mile of land approximately 1,000 persons are required for the production and marketing of the crop. Wages there are low enough, however, to permit medium-grade jute fiber to sell at an average of 4 to 4.5 cents per pound on the New York wholesale market during the last 5 years before the outbreak of war.

In the Amazon Valley a plantation consists of many small areas, frequently located on higher patches of ground like small natural levees surrounded by water. The worker has to go to his field and from one patch to another by boat. This condition, as well as the small size of the fields, their isolated location, and the prevalence of stumps and brush

Miss Protzman is Junior Agricultural Economist in the Division of Cotton and Other Vegetable Fibers, Office of Foreign Agricultural Relations. This article is based largely on reports submitted by Henry W. Spielman, of the American Consulate General in São Paulo, Brazil, and Kenneth Wernimont, of the United States Embassy, Rio de Janeiro, Brazil.

left by clearing, makes impossible the use of machines.

In Espirito Santo, upland areas are prepared with tractor plows and disc-harrows, the seed is planted with mechanical seeders, the stalks are cut with power harvesters, and retting takes place in tanks built for the purpose. After the retting, however, the preparation of the fiber must be done by hand.

Low-land cultivation is picturesque but involves hard labor and disagreeable working conditions. All work is determined by the rainy seasons. Clearing of the land takes place in time for the brush to be burned during the driest season, usually October and November, and the soil to be prepared and the seed to be planted before the rainy season begins. Delay in planting results in insufficient time for growing before the floods come. The crop requires about 120 days to mature, and only 3 or 4 months elapse between the first rains and flood waters high enough to threaten any crops still standing. Little care is necessary during the growing season, since the rapid growth of the crop soon chokes out weeds and grass.

Jute stalks grow long and slender. When the plant is about 6 to 12 feet tall, small yellow flowers appear and serve as heralds of harvest time. The fiber is obtained from the inner bark and belongs to the group of bast fibers which includes ramie, flax, and hemp. The clean fiber is soft and long, but not as strong as hemp, flax, or cotton.

The harvest season is short and scarcity of labor at this time may result in great loss. Many farmers begin harvesting their crop soon after the flower buds appear and continue cutting as long as the rising water permits. This practice results in great variation in the quality of fibers and increases grading problems. The stalks are cut several inches above the ground and tied into bundles, which are then weighted down under water for retting.

The retting process consists of soaking the stalks until the tissues surrounding the fibers have become so softened that they can be scraped and washed away, leaving only the clean fiber. Careful judgment in timing is necessary in order to obtain a fiber that is thoroughly clean without being weakened by over-processing.

Cleaning is always done by hand, and from late March through June workers are often seen standing waist high in water and beating long bunches of fiber into the water to remove all waste material. In higher regions where the fiber is processed on dry ground the women help to scrape and carry it to nearby streams for washing. Both women and children spread the clean fiber on long racks in the sun and care for it during the drying stage. Great care is necessary in this work, as improperly dried fiber deteriorates in color and strength and sells on the market at reduced prices.

Two crops may be produced each year. The first harvest usually occurs between late March and the end of June.

Jute fiber piled on the dock at Obidos waiting to be loaded on a river steamer for Belém.

The second crop is planted immediately and is ready for harvest in October or November.

Jute Workers

There are now in the Amazon Valley about 5,000 families consisting of approximately 30,000 persons who are engaged in growing jute either as independent farmers or as hired laborers. Two types of farms are common in the region. The larger ones are usually owned or leased by businessmen, often merchants of nearby cities, or firms who hire laborers to clean the land, plant the seed, harvest the crop, and process the fiber. Wages vary with the type of work, and are relatively good, but last only through the working season. The smaller farms are owned and tended by individual farmers. A man with his family can handle the crop from 2 to 5 acres of jute without outside help.

During the busy season several families live temporarily on a commercial plantation. Living quarters, which are furnished, often have little space and minimum facilities. All buildings are necessarily located on the highest ground away from the main flood waters. The work building used for sorting and bundling the fiber is much like the family building, but without walls. The family's hut is constructed with the floor 3 feet or more above the ground, with palm-leaf walls and palm-thatched roof. Floor space is small. The family sleep in hammocks, which are strung between poles of the walls at night, then rolled up in daytime.

Cooking is done on simple charcoal-burning stoves which may be placed on an adjoining porch-like structure. Food is kept in a separate place partitioned off from the living room. Storage is a problem as there are few, if any, means of protection against mold, weevils, or insects. Staple food for the family consists mainly of coffee, sugar, beans, rice, manioc meal, and dried fish.

Conditions are best during the dry season. Toward the close of the rainy season a family may find that its front lawn has become a retting pool and boats are necessary for all transportation. The men may stand in water immediately outside the door to clean and wash the fiber from the rotted jute stalks, while the women must wade through water while tending the fiber on the drying racks.

Bundles of fiber being retted in the pools in the foreground. Jute in the background has been left for seed.

The small independent farmer is usually more stable than the hired worker on the larger plantation because he spends his full time on his farm, has his own family living quarters, and often raises a few chickens and a pig. The hut is built, whenever possible, on ground high enough to be beyond reach of the river. When this can be done, the farmer often raises small amounts of manioc, rice, pineapples, and sugarcane which he uses to supplement his income from the jute crop.

These growers can now receive aid through crop loans from buying firms of Manaus and Obidos. Loans are made for amounts up to $12.50 per acre for planting expense, and at about 1½ cents per pound for harvesting. Such loans were first made during the past year, and were so successful that the system will probably be extended.

Encouragement is needed, because life in the tropics is beset with such hardships as insects, snake bites, malaria, and malnutrition. Any measures that decrease these hazards to the workers and their families will result in benefit to the jute industry as a whole.

Use of Jute in Brazil

Before the present war, jute fiber worth $3,000,000 a year was imported into Brazil for manufacture. Most of it was shipped directly into the State of São Paulo, which is the center of the jute textile-manufacturing industry of the country. Here it is manufactured into burlaps, hessians, and bags to be used as containers and wrappings for coffee, sugar, grain, cocoa, potatoes, babassú kernels, castor beans, feed, fertilizers, wool, cotton, and other farm products. The coffee crop alone requires about 15,000,000 bags each year, and in pre-war years the number was even greater. Jute is also used in the manufacture of rugs and carpets and for cloth for the backing of linoleum and oilcloth.

Jute on the Market

Although the cost of producing a pound of jute in Brazil is estimated at from 3 to 4 cents per pound, the consumer must pay considerably more than this, since the expense of transportation over the long distances from the plantations to the mills is often as great as the production cost. The fiber is sold on the market according to samples, because standardization of quality has not been completely established. An official service, started in 1941, involving specifications for designated classifications of fiber, has helped considerably toward establishment of standards, which should be a large factor in the increasing success of the jute industry in Brazil.

U. S. Forest Service Photo

When guayule is gathered, the entire plant is pulled up by the roots. The shrubs are arranged in bunches on ropes laid out on the ground. When a sufficient number have been collected, they are tied into bundles and transported by burros.

Rubber From Guayule

As a means of securing natural rubber quickly guayule offers great possibilities. Experiments in the cultivation of the shrub are being conducted in Latin America.

by **LOREN G. POLHAMUS**

The chaotic condition of the world, even in 1940, was a factor in the initiation of a coordinated effort to lay the groundwork of a permanent self-sustaining rubber agriculture in the Americas, based principally on cultivation of hevea rubber trees. When, however, a quicker-producing rubber plant was needed to provide for a more rapid expansion than would be possible with hevea, attention turned to the wide-branching, woody shrub called guayule (*Parthenium argentatum*), which grows wild in the dry tablelands of north-central Mexico and Texas. Guayule may not be the whole answer, but experiments have shown that this shrub is definitely a potential source of rubber.

The North American Indians had made bouncing balls of an elastic substance from the guayule shrub, and since about 1900 experiments in extraction of rubber from the plant had been under way in Mexico and Texas.

Six months before Pearl Harbor, a bill was introduced in the House of Representatives of the United States Congress providing for the planting of 45,000 acres of guayule in the United States as an emergency source of rubber. A second bill to accomplish this purpose was passed by the House on February 5, and by the Senate on February 9, 1942. On February 17, the President vetoed this bill because it restricted plantings to the United States. When the bill was amended to allow plantings anywhere in the Western Hemisphere, it was quickly passed by Congress and was signed by the President.

Department of Agriculture Given Responsibility

Under the law as passed, the Secretary of Agriculture was given the administrative responsibility for the program.

Courtesy of Continental-Mexican Rubber Co.

Field planting of guayule in Mexico.

He designated the U. S. Forest Service to be responsible for the administration of the program, with authority to call upon the Bureau of Plant Industry, Soils, and Agricultural Engineering, the Bureau of Agricultural and Industrial Chemistry, the Bureau of Entomology and Plant Quarantine, and other Bureaus of the Department for necessary services.

The work of the Bureau of Plant Industry, Soils, and Agricultural Engineering was divided into two parts: One, under the leadership of Dr. A. C. Hildreth, had to do with basic research on all phases of guayule cultivation in the United States; the second, under the leadership of Dr. E. W. Brandes, was, in coordination with other investigations of rubber production in Latin America, to determine areas in those countries where conditions were favorable for the cultivation of guayule and to initiate indicator plantings.

Experiments in Latin America

The first planting of guayule in Latin America under this project was made at Gomez Palacio, Durango, Mexico, in the spring of 1942. This planting was made on land selected in consultation with representatives of the Mexican Department of Agriculture.

Later the same year, Professor H. H. Bartlett, of the University of Michigan, who had had long experience in surveying native stands of guayule in Mexico, was given leave of absence to take charge in the field of the preliminary phases of establishing plantings of guayule in Latin America. After a brief study and conference period in Salinas, California, where the plant was already under cultivation, he spent 18 months in surveying areas in Chile, Argentina, Uruguay, and Mexico, determining where natural conditions seemed favorable for the growth of guayule, and furnishing advice and assistance in the establishment of guayule nurseries. In the meantime, plant experts had been sent to northern Mexico. One group, under the direction of C. K. Cooperrider, of the U. S. Forest Service, surveyed native stands of guayule and made surveys of soils, vegetation, meteorological conditions, and irrigation possibilities to determine areas where cultivation might be possible. A second group, from the Bureau of Plant Industry, Soils, and Agricultural Engineering, initiated experimental plantings of guayule in cooperation with the Mexican Department of Agriculture and advised with private producers of wild guayule rubber interested in planting guayule.

Certain rules have governed selection of favorable sites in Latin America. While guayule is native in northern Mexico, it is confined to areas in which conditions are adverse to its most rapid growth and best development. Competition and local soil conditions have allowed guayule to persist only in areas not conducive to survival by highly competitive vegetation. The natural range of guayule indicates its minimum requirements for survival rather than its optimum requirements for growth and rubber accumulation.

Experiments in United States

Prior to the war, little study of guayule culture had been made in Latin America. In the United States, extensive studies by a commercial concern had indicated that guayule could be grown on a variety of soils, both with and without irrigation. Moisture requirements for forced or for slower growth had been determined within general limits. There was a knowledge of tolerance of guayule plants to extremes of cold. With initiation of the Emergency Rubber Project, there was a rapid increase in knowledge of factors affecting growth and rubber accumulation in guayule. This information pertained to conditions in the United States and had to be interpreted in relation to conditions and concepts in Latin America.

In the United States, the primary object was to produce rubber in the greatest quantity possible in the shortest time possible. This necessitated adoption of cultural methods already tried and proved. It also meant establishment of extensive nurseries equipped with expensive overhead-irrigation systems. Above all else, it involved planting guayule on irrigated land where growth could be forced as rapidly as possible.

Selection of suitable land in the United States was difficult, both because of lack of complete information as to the requirements of the plant and because of the necessity of fitting guayule culture into an agriculture extended to the utmost to meet its share of the war effort. In Latin America, the same problems existed.

Conditions in Mexico Representative

Before initiating surveys to determine desirable areas for starting guayule plantings in Latin America, a concept

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The author has been carrying on rubber research for the Department of Agriculture for more than 25 years and has conducted experiments in the West Indies and in Central and South America. At present he is Principal Agronomist for Rubber Plant Investigations of the Bureau of Plant Industry, Soils, and Agricultural Engineering.

of the type of soil and climatic conditions to be sought had to be developed, including consideration both of the requirements of the guayule plant itself and of agricultural development and facilities in Latin America. To a large extent, conditions in northern Mexico are typical of those existing in areas in Latin America where the cultivation of guayule may be expected to be successful, and this area will be used to illustrate the various factors influencing the choice of land for guayule-cultivation experiments.

Guayule is native to a large area in north-central Mexico. The most extensive natural stands are found in the States of Chihuahua, Coahuila, Durango, Nuevo León, San Luis Potosi, and Zacatecas. Guayule stands in Mexico are not continuous but are scattered over an immense area nearly 500 miles from north to south and more than 300 miles from east to west.

As an example of where guayule will survive and accumulate rubber, the natural range is excellent, but as an example of where guayule can be grown commercially it has certain basic defects. Most important of the defects is lack of dependable rainfall. In much of the area where guayule occurs naturally, average annual rainfall is deficient and long-continued droughts are common. Guayule survives and maintains itself, but 10 to 20 years may be necessary for the plants to reach a sufficient size and rubber content for harvesting.

Length of Growing Cycle

For commercial production of cultivated plants for rubber extraction, it is necessary to reduce the growth period to a minimum. In the United States this minimum may be as little as two growing seasons if intensive agricultural practices, particularly irrigation, are used. For minimum cost production of rubber, however, the minimum growth period must be defined both on the basis of growth rate and on the cost of producing the plants and extracting the rubber.

Under cultivation in the United States, it has been demonstrated that in the fourth to fifth season in the field guayule plants may contain as high as 15 to 20 percent rubber (dry weight) and produce up to 1,600 pounds or more of rubber per acre. If the plants are harvested at the end of the second year in the field, the rubber content may be only from 6 to 8 percent. The cost of extracting rubber from plants containing 6 to 8 percent is much greater than from plants containing 15 to 20 percent because of the relative amount of plant material that must be handled to obtain any given quantity of rubber. On the other hand, maintenance of plantings for 2 to 3 additional years in the field also is an element in the cost of production. This element is more than offset, however, by the fact that a considerable factor in cost of production is the planting and maintenance of nurseries and transplanting to the field. On a 2-year cycle, this cost would be encountered twice as often as on a 4-year cycle. Assuming only a doubled increase in rubber production by allowing the plants to stay in the field for 4 years instead of 2, the nursery and planting costs per pound of rubber produced would be twice as great for a 2-year cycle as for a 4-year cycle. New aspects of guayule cultivation being investigated under Dr. Hildreth's direction and being tested also in Latin America involve the elimination of nurseries by direct seeding in the field and cutting down of replanting costs by harvesting only the above-ground portions of the plant, leaving the roots, from which new tops are produced.

Irrigation Versus Dry Land Culture

Under wartime conditions, rubber has had to be produced as rapidly as possible. Small quantities available immediately were considered much more important than larger supplies 4 years in the future. It was necessary to set the sights of the Emergency Rubber Project on the immediate production of maximum quantities of rubber, but the immediacy of the need was emphasized over the maximum quantity. This was accomplished in the United States by forcing the plants in the nursery and in the field by optimum use of irrigation. Even in the United States, however, the use of irrigated land for guayule cultivation seemingly brought the rubber program into competition with food production. In Latin America, this competition would be much more intense and real. To understand this situation, one must realize that the area of irrigated lands in north-central Mexico is one of the most important food-producing centers in that country. The irrigated lands are insufficient for food-production demands and during the war this deficiency has become intensified. It was necessary, therefore, in selecting land in the general area of the natural stands of guayule, to find lands where new irrigation facilities could be developed or to select lands with sufficient rainfall to bring plants to the optimum harvest size in a comparatively short period of time.

The critical need of conserving available cultivated land in Mexico for food production was recognized by the Gov-

Newly prepared guayule nursery beds depressed for flood irrigation.

ernment of Mexico. To discourage or prevent the utilization for guayule cultivation of land already under cultivation or for which irrigation facilities already were available, President Avila Camacho issued a Decree, which was published in the "Diario Oficial" of July 17, 1943. This Decree states in detail how lands may be acquired for the cultivation of guayule, but provides that no land may be acquired for that purpose if it has been used for any agricultural pursuit within 10 years.

In Mexico, and in other parts of Latin America, the possible use of irrigation, particularly where new facilities could be developed, was considered, but primary interest was in determining areas where guayule might be grown without irrigation. This necessitated a search of available weather records to determine the known facts in regard to

Courtesy of Continental-Mexican Rubber Co.

Nursery beds near Torreón, Coahuila, Mexico, equipped for overhead irrigation.

total rainfall and the annual distribution of rainfall. At Salinas, California, the optimum conditions had been found to be moderate winter rainfall with little or no precipitation during the summer. Throughout the area of northern Mexico considered for guayule cultivation, it was found that the annual distribution of rain was the reverse of that at Salinas in that the main precipitation was in the summer rather than in the winter. Experience in Texas, however, indicated that this rainfall distribution was favorable for the growth of guayule and the accumulation of rubber.

While there was considerable information on rainfall in particular areas of northern Mexico, it was not possible to rely on these records for exact determination of the specific areas to be considered for experimental plantings. Professor Bartlett found it necessary to depend to a great degree upon the vegetation existing in an area to indicate the total rainfall and the rainfall distribution. Having observed the vegetation in the north-central part of Mexico, he determined those types that grew or survived under conditions comparable to those where guayule survived, but he added a new concept—he required that any land for growth of guayule without irrigation must already support a full cover of natural vegetation. Normal concepts of good friable soil were considered, available rainfall records were utilized, but chief reliance in the final estimate of general areas for guayule cultivation was placed on the ability of the area to maintain under natural conditions a full cover of plants whose requirements compared with those of guayule. Under this concept, the actual areas where guayule is native were not considered promising but contiguous areas, favored by more abundant rainfall and able to support a full cover, were given consideration. In Mexico, the most promising area was found to be the high, fertile grassland areas of the States of Durango and Zacatecas and similar areas in the States of San Luis Potosi, Guanajuato, and Nuevo León. Similar favorable areas were found in Chile, Argentina, and Uruguay.

Test Plantings in Latin America

In initiating test plantings in Latin America, it was felt at first that nursery plants could be shipped from the United States. Because of transportation difficulties, it was found impracticable to ship seedlings to South America and the decision was made to establish nurseries for local production of plants for transplanting. Nurseries were established at Payne in Chile; at Salta, Catamarca, San Juan, and Mendoza in Argentina; and at La Estanzuela in Uruguay. In Mexico, first reliance was placed on seedlings shipped from Salinas but later a nursery was established at El Mante and a second at Saltillo. Still later, the nursery work was discontinued and arrangements were made to obtain plants from a private company at Torreón which was cooperating in the work.

Field test plantings in Mexico were established at Saltillo, Parras, Cuatrocienegas, and Torreón in the State of Coahuila; Monterrey in the State of Nuevo León; Guadelupe Victoria in the State of Durango; Sombrerete in the State of Zacatecas; and León in the State of Guanajuato. Plantings at Parras, Torreón, and Cuatrocienegas were made in cooperation with private companies. All other plantings were made on land supplied by the Mexican Department of Agriculture. At Saltillo, Parras, Torreón, and Cuatrocienegas there is a deficiency of rainfall, and irrigation must be used to obtain adequate growth. All other areas have a sufficient rainfall to support a full ground cover and may be expected to produce guayule without irrigation.

Place of Guayule in the Future

The future success of guayule cannot be fully foreseen at this time. A good start has been made in establishing the foundation for an economical cultivation of the shrub in Latin America and the extraction of rubber from it. Of one thing we seem assured—guayule must be considered a definite factor in the post-war potential source of rubber.

The Inter-American Institute of Agricultural Sciences

The newly established Institute of Agricultural Sciences at Turrialba, Costa Rica, is an example of inter-American cooperation designed to encourage the development of agricultural sciences and to aid the economies of all the American Republics.

by **JOSE L. COLOM**

On November 30, 1944, the Convention on the Inter-American Institute of Agricultural Sciences came into effect, placing the Institute on a permanent basis as an inter-American organization. This Agreement was opened to the signatures of the American Governments on January 15, 1944, and to date has been signed by the following countries: Costa Rica, Nicaragua, Panama, United States, Cuba, Ecuador, Honduras, the Dominican Republic, El Salvador, Guatemala, Uruguay, Chile, Bolivia, and Venezuela. It has been ratified by El Salvador, the United States, Guatemala, Costa Rica, Nicaragua, the Dominican Republic and Honduras.

The need had long been felt for a central inter-American organization to carry out certain projects in agricultural and livestock research which require methodical study and joint action by both the Governments and scientists in the Western Hemisphere. The First Inter-American Agricultural Conference, held in the City of Washington in 1930, approved a resolution recommending the establishment of a Pan American experiment station, a long-term project that could be carried out only by Pan American effort. The Conference recommended to the Governing Board of the Pan American Union that it should consult the opinion of the Governments belonging to the Pan American Union and obtain the advice of their specialists about the establishment of such a station to "serve as a center for the development of research on plant diseases, the introduction of new plants, studies in entomology, soils, seed improvement, and other technical research in agriculture, silviculture, and animal husbandry, and contribute along scientific lines to

General view of experimental plots at the Inter-American Institute of Agricultural Sciences.

Plants requiring partial shade are developed in this lath propagation house.

the program of agricultural diversification in the countries of America."

The Eighth American Scientific Congress, held in Washington in 1940, approved a similar recommendation, and the Governing Board of the Pan American Union appointed an Organizing Committee composed of representatives of Bolivia, Brazil, Colombia, Costa Rica, Ecuador, El Salvador, the United States, Guatemala, Mexico, Peru, and Venezuela. This committee, in turn, appointed a Technical Commission made up of specialists from the U. S. Department of Agriculture to select the site for the station. Twelve republics offered land for the establishment of the Institute in their territories. The place selected was to be in a location suitable for such experimentation and as nearly as possible equidistant from all the countries of the Americas and readily accessible to them.

On the basis of the report of the Technical Commission the Governing Board of the Pan American Union approved the site offered by the Government of Costa Rica for such purpose.

Turrialba Selected

The site selected was in central Costa Rica in the region known as the Valle del Reventazón, near the city of Turrialba. Part of the region is on a tableland at an elevation of 2,000 feet, with mountains and hills partly surrounding it. Without being actually on the coast, there is in the eastern part a section representative of the damp lowlands of which such large areas exist in tropical America. Within a distance of less than 2 hours by automobile or train the Institute can offer a complete panorama of the conditions existing in the American tropics.

The Government of Costa Rica generously contributed the necessary land to the Institute, an area comprising 2,500 acres.

The Institute maintains a sub-station for rubber investigations on Lake Gatún in the Republic of Panama, comprising 2,800 acres and acquired from the Goodyear Rubber Plantations Company.

Management

Management of the Institute is vested in a Board of Directors composed of representatives of the 21 American republics making up the Governing Board of the Pan American Union, assisted by an administrative committee and a technical advisory council, with headquarters of the Central Executive Office in Washington, D. C. The Director is Dr. Earl N. Bressman, formerly an official of the U. S. Department of Agriculture and subsequently Director of the Agricultural Division of the Office of the Coordinator of Inter-American Affairs.

Work began on funds supplied by the Government of the United States through the Office of the Coordinator of Inter-American Affairs. The Institute is to be supported, in addition to contributions, legacies, and donations, by annual quotas from the countries which have signed and

One of the features of the campus is an attractive lake.

ratified the Convention governing its operation. At the meeting of the Governing Board held on October 4, 1944, the annual quota of each of the contracting States was fixed at 1 dollar, United States currency, for each thousand inhabitants. Several countries have already made their contributions to its support.

Progress Made

In March 1943 His Excellency Dr. Rafael Angel Calderón Guardia, President of Costa Rica, and the Hon. Henry A. Wallace, Vice President of the United States, inaugurated the work of the Institute by laying the cornerstone of the first permanent building. At the present time several buildings have been erected. Permanent dormitories for

The author is Chief of the Division of Agricultural Cooperation of the Pan American Union and Secretary of the Inter-American Institute of Agricultural Sciences.

the students, residences for faculty, buildings for offices, and other construction are finished or nearing completion.

Already the Institute possesses an extensive collection of botanical works which belonged to the late Dr. William A. Orton, former Director of the Foundation for the Study of Tropical Plants. This will form the nucleus for a library of tropical agriculture which will be enlarged as rapidly as possible.

The Institute is launching various projects of experimentation and research. Cinchona is growing on the hillsides near Turrialba. Coffee, cacao, sugarcane, corn, rice, fruits, and vegetables grow well, and the region is excellently adapted to experimental work with livestock, especially dairy stock, under tropical conditions. There are facilities for research on erosion control in tropical regions. The Experiment Station for the Study of Rubber, established by the U. S. Department of Agriculture in cooperation with the Government of Costa Rica, is adjacent to the Institute, as is also the Goodyear Company plantation.

One of the projects being carried on at the Institute is the development of hybrid grapes for tropical climates.

The Program

The Institute aims to stimulate and promote the development of agricultural sciences in the American republics through research, education, and the dissemination of the science and practical procedures of agriculture. It will be devoted to the training of young graduates from agricultural schools who will later be able to aid the progress of agriculture in their respective countries. During the first year the Institute plans to offer 21 scholarships—1 for each of the American republics—to men students who hold the degree of Bachelor of Agricultural Sciences or an equivalent degree. Students will stay at the Institute from 1 to 3 years, devoting part of their time to organized course work but spending the greater part of the time in research problems concerned with the division of agricultural science in which they wish to specialize. The degree of Master of Science will be received by students who satisfactorily complete the work of the Institute.

To resist earthquakes, heavy reinforcements are used in the construction of this dormitory.

Guest house for use of visitors.

Four broad departments are planned: Animal husbandry, agricultural engineering, plant industry and soils, and economics and rural life. Each department will be directed by a chief, whose principal obligation will be that of organizing and carrying out the investigations and of teaching a number of graduate students. The plan is that no more than 10 graduate students will be assigned to each department, so that all may receive special instruction. In addition, the departments offer seminar courses, not only for students assigned to them but for all students.

A group of distinguished scientists from the American republics will form the personnel and faculty of the Institute. They will be selected not only for their skill in the field of their specialty but also for their demonstrated ability to inculcate in their students some of the characteristics which made them eminent experts in their field.

Technical research in the various fields of agriculture will receive major attention in the early years of the Institute. Experimentation in crops for the different republics will extend and supplement the national programs of the various countries rather than compete with them. The establishment of trained agricultural experts in all the republics can be forwarded in collaboration with the respective national institutions. The Inter-American Institute of Agricultural Sciences at Turrialba promises to be of inestimable value to the Western Hemisphere.

Living Fence Posts in Cuba

Fences can be beautiful as well as useful. The "living" fences in Cuba serve both purposes, and there is even a possibility of a third use.

by JULIAN C. CRANE

One of the most impressive sights to a person traveling through Cuba is the mile after mile of *setos vivos* or living fences. If you are there during the flowering season, from January to April, and if the living fences that you observe are of *Piñón amoroso,* as they are likely to be because that is the favorite tree for the purpose, you will see masses of rose-colored blossoms topping the fences along the railroads and highways and enclosing practically every field or tract of land. The term "living" is used because the posts, to which are fastened from 2 to 8 strands of barbed wire, are really live tree trunks, the terminal branches of which are cut off periodically to the desired height.

The history of the living fences in Cuba is closely associated with the development of the cattle-raising industry. Previous to about 1550, while the cattle industry was in its infancy, fences, or lines of demarcation, were not necessary, since grazing was done in open *sabana* land. From the middle of the sixteenth to the beginning of the eighteenth century the Spanish Government made land grants or *mercedes.* To the large cattle raisers went circular tracts of land approximately 6 miles in diameter, which were called *hatos,* and, to the smaller stock owners, tracts half that size, called *corrales.* During the early part of the eighteenth century, when the cattle industry had grown by leaps and bounds and these land grants had begun to overlap each other, land owners began staking out their legal claims and erecting fences around them.

Newly planted fence of *Bursera simaruba,* "almácigo," in Pinár del Rio Province, Cuba.

Plants Selected for "Living" Posts

Because of the scarcity of stones in some parts of the island and the rapidity, in that climate, of decay and termite damage to fences made of cut wood, attention was turned to thick-growing and barbed plants which could be used as "living" fences. There were several of them. The first one that was tried was a plant (*Bromelia pinguin*) much like the pineapple plant, known in Cuba as *piña de ratón.* Many fences made of this plant are still found throughout the island. It has been losing popularity, however, and is being replaced by other types until now it ranks, perhaps, fifth in importance as fence material and is used only around small plots of fruit trees and gardens. The reason for its decline is that it requires too much attention and work to keep its suckers from spreading over the land. Other plants used in various places on the island were *caña brava* (*Bambusa vulgaris*), *espino* (*Yucca aloifolia*), *abrojo* (*Pereskia grandifolia*), and *cardón* (*Euphorbia lactea*).

With the introduction of barbed wire in the latter part of the nineteenth century came the need for a quick and straight-growing tree with few branches which could be propagated easily from cuttings and to which the wire strands could be attached. Several plants native to Cuba were selected and tried. *Erythrina berteroana,* known locally as *piñón de pito,* "whistle pine," because the *guajiros* (country boys) make whistles from its flowers, is today perhaps the second-most-important plant used for

Dr. Crane, Associate Agronomist in the Office of Foreign Agricultural Relations, has been stationed in Cuba for the past year and a half, where he is conducting experimental research on fiber plants in collaboration with the Cuban Ministry of Agriculture.

The author is indebted to Ing. Julián B. Acuña of the Cuban Agricultural Experiment Station for botanical identification and suggestions in the preparation of this article.

fences. *Almácigo* (*Bursera simaruba*) has ranked about fourth in importance but is gradually losing favor because nails or staples will not stay in the wood for any length of time. *Spondias lutea* and *Cochlospermum vitifolia,* called by the Cubans *ciruela amarilla* and *botija,* are sometimes used.

In addition to the trees native to Cuba, several species were introduced from other tropical countries. Foremost among these is the *piñón amoroso* (*Gliricidia sepium*), which ranks number one on the list of importance and is used all over the island. It is gaining in popularity and is rapidly replacing some of the other types which have various disadvantages. This tree, with its straight trunk and few straight branches, is easy to work with even though its wood is considerably harder and more durable than that of any other plant used for fence posts. In contrast to the beauty of its rose-colored flowers, its bark has a bitter taste, which protects the tree from nibbling by cows and hogs. This species does not grow well on poor, thin, rocky land, but another introduced species, *piñón de botija* (*Jatropha curcas*), does and it also has a bitter-tasting bark. *Jobo* (*Spondias mombin*) has ranked about third but its importance is decreasing because it produces a fleshy yellow fruit which when eaten by cattle gives a bad flavor to the milk and impairs its keeping qualities. *Sasafrás* (*Bursera graveolens*) and *cardón de hoja* (*Euphorbia nivalis*) are losing favor as living fences because the latex secreted from their stems produces a skin irritation similar to that produced by poison ivy.

The many species of *Erythrina,* with their coral-colored flowers, are great favorites. *Piñón real* (*Erythrina grisebachii*) is common in two provinces, Pinár del Rio and Habana, and is almost the only species used for fences in the northern part of Habana, especially along the Hershey railroad, which extends a distance of 60 miles from Casa Blanca to Matanzas. *Bucare* (*Erythrina poeppigiana*) is used in small quantities, as are also the cashew nut tree *marañón* (*Anacardium occidentale*) and *palo jeringa* (*Moringa pterygosperma*).

Construction of the Fences

With the exception of *Anacardium occidentale* (cashew nut) and *Jatropha curcas,* which are propagated by seeds as well, the majority of living fences in Cuba are started by merely driving branches into the ground and stapling two or three strands of barbed wire to them. Straight branches from 3 to 4 inches in diameter and 5 to 6 feet in length are preferred by most farmers. Branches are cut, usually during the months of February, March, or April when the trees have no leaves, and are trimmed and shaped at the butt end. Shaping consists of a diagonal cut from one side of the branch to the other, leaving at the end an exposed surface of from 6 to 8 inches in length. This type of cut exposes a larger amount of cambium tissue, from which the new roots grow, than if the branches were pointed, and by enabling a deeper penetration into the earth increases resistance to drought.

The best time for making a fence is at the beginning of the rainy season, which generally starts in May or June. Posts may be set any time of the year but if this is done during the dry season or in summer when the plants are in full leaf a higher percentage of the posts fail to root and will eventually die. Branches or posts cut in February may be kept alive without planting until May. They may be shipped, therefore, over long distances, without danger of loss, to parts of the island where a particular species may not be plentiful.

There appears to be no standard distance between posts in the fence row or in the number of strands of barbed wire used. Sometimes posts are set as close as 1 foot or they may be 10 feet apart, and the number of strands of wire may be 1 or 8.

On well-kept and prosperous farms, posts which have failed to grow are replaced with live ones and the fences are topped or pruned with machetes to a uniform height every year or, at most, every other year, generally during February and March or just after flowering.

The advantages of living fences in the Tropics are obvious. Whereas the wood which in temperate regions is hardest and most durable for fences will last only a comparatively short time in the Tropics under the conditions too favorable to rapid decay, there are several living fences in Cuba which are over 100 years old and are still in good condition. They are termite- and fire-resistant and serve as excellent windbreaks. Still another advantage, and an im-

(*Continued on page* 38)

Fifty-year-old fence composed of *Gliricidia sepium* and *Erythrina berteroana*, "*pinón de pito*."

ALONG THE

Agricultural Front

▲ Panama Buys Cuban Livestock for Breeding

To assist Panama in securing properly acclimated breeding stock for the improvement of its beef and dairy industry, the Cuban Government during the past year granted permission for the exportation to Panama of 200 head of cattle for breeding purposes. The decree stipulated that the Cuban Ministry of Agriculture must certify that all animals exported to Panama are properly classified as breeding stock.

Cuba's breeding stock in general is better than that of some other Caribbean areas. The Cuban animals are acclimated to the tropics and are considered in many quarters to be a good source of stock for herd improvement. The principal pure-blood strain available in Cuba is the Brahman or Zebu, which is popular in the Caribbean area. Panama buyers have been purchasing this strain and the Holstein and Jersey, which are relatively scarce as the Cuban cattle industry has been placing more emphasis on such breeds as Santa Gertrudis, Brown Swiss, and Shorthorn.

▲ Haiti Inaugurates Food Production Program

A food-production program is being inaugurated in Haiti, to be operated on lands formerly devoted to cryptostegia. One purpose of the program is to prevent weevil and rodent damage to harvested crops, by the installation of more than 70 silos. Another purpose is to establish grain markets so that prices may be stabilized. Linked with this is the provision for a stockpile of agricultural produce in order to encourage more uniform plantings. Still another important part of the plan is to increase the present production of foodstuffs by using more land for that purpose and by distributing seed and equipment to the small farmers, with an inspection service established to see that the material is used to the best advantage in producing food. The program is to be supported by both the Office of the Coordinator of Inter-American Affairs and the Haitian Government.

ROBERT H. INGRAM RECEIVES PROMOTION

The many friends of Robert H. Ingram, who was editor of *Agriculture in the Americas* before he entered the Army Air Forces in 1942, will be glad to learn that he was recently promoted from first lieutenant to captain.

Captain Ingram is serving as communications officer of the 34th Bomb Group, a B-17 Flying Fortress unit of the Eighth Air Force. This group is a unit of the Third Bombardment Division which was cited by President Roosevelt for its now historic England-Africa shuttle bombing of Messerschmitt plants at Regensburg, Germany.

As Station communications officer, Bob is responsible for maintaining the vital link between the base radio station and the Flying Forts during their penetrations to the heart of the Reich on bombing attacks, which are softening Nazi resistance for the advance of the Allied armies, and for guiding returning bombers through hazardous flying weather.

▲ Brazil Reorganizes Forestry Service

Aroused by the rapid devastation of forests to meet the demands of wood-burning locomotives and charcoal-operated automobiles, the Ministry of Agriculture of Brazil recently reorganized its Forestry Service to cope more efficiently with the situation. Under the plan a definite program will be carried on for the care, maintenance, protection, and improvement of the deforested areas.

In addition to the increased demands for fuel wood, there is said to be a great shortage of cabinet and construction woods, especially near the large centers of population. In many places in Central Brazil the forests have been so completely destroyed that farmers have difficulty in securing firewood for household purposes.

▲ Peruvians Establish Animal Sanitary Board

The recent outbreak of a virulent form of hoof-and-mouth disease in Peru has instigated the establishment of an Animal Sanitary Board, composed of officials of the Ministry of Agriculture and Public Health and representatives from the National Agrarian Society, National Livestock Association, and National Board of Wool Industry. The Board is empowered to supervise all activities relative to animal sanitation and quarantine.

During the past year, the Inter-American Cooperative Food Production Service (Coordinator's Food Mission) of the Ministry of Agriculture has been engaged in the construction of animal-quarantine stations at Callao, Arequipa, and Puno.

▲ Brazil to Establish Agricultural Warehouses

In line with the plan to increase food production and to relieve the shortage of storage space for agricultural commodities, the Brazilian Ministry of Agriculture has inaugurated a plan for the establishment of warehouses throughout the farming areas of that country. Lack of storage facilities has resulted in enormous losses, especially in recent years, and is an important factor in retarding the movement of many important agricultural products.

THE RIVER BASINS OF PERU

(*Continued from back cover*)

heart of this mountain region and contain about 70 percent of the country's inhabitants.

The most important rivers in the Sierra are the Marañón, Huallaga, Mantaro, and the Apurímac. The Río Marañón is the most western tributary of the Amazon River and flows 400 miles in a northern, then eastern, direction through the Sierra, dropping in elevation 10,000 feet as it flows over precipitous falls and rapids. It has cut a canyon deeper than the Grand Canyon of the Colorado in the United States and it enters the forest region of the Montaña after flowing over the series of falls and rapids known as Pongo de Manseriche.

The Río Huallaga has its headwaters just north of Cerro de Pasco, the famous mining center, and is the principal tributary of the Río Marañón. At Huanuco the valley of the Huallaga is about 5,000 feet deep. This valley is an irrigated agricultural area. Alfalfa is the favorite crop, but citrus fruits, pineapples, bananas, and sugarcane are grown in the lower part. On the larger estates cotton is extensively grown, and coffee plantations are seen farther down the river. Coca, the plant from which cocaine is derived and the leaves of which are chewed by the Indians, is grown on the western side of the Huallaga, in the vicinity of Huanuco.

The Río Mantaro flows through the central part of the Sierra where the chief mining districts are, furnishing water for mining operations. Gold, silver, and many useful war materials such as copper, lead, tungsten, antimony, and vanadium are produced in this area and make up a large percentage of the total exports from Peru. About 173,900 acres, or three-fifths of Peru's wheat acreage in 1941, was harvested in the Departments of Junín, Huancavelica, and Cusco, in this area. Other small grains, potatoes, and fruits suitable to temperate climates are also grown in the vicinity of the Río Mantaro. Livestock in general is produced in this area, especially the famous Karakul sheep. The skins of the lambs are used for high-grade fur, which is sold under various trade names.

On a high plateau near Lake Titicaca, the Río Apurímac, the most far-reaching branch of the Amazon, has its source. Vicuñas, which produce a fine grade of wool, and llamas and alpacas are found on the high plateaus in this area. Sheep and other livestock are raised extensively in the lower areas. The well-known geographer, Isaiah Bowman, reports a shepherd's hut in the southern Peruvian mountains at an elevation of 17,100 feet, which is believed to be one of the world's highest permanent human habitations.

Lake Titicaca, located on a plateau approximately 12,500 feet above sea level, is partly in Peru and partly in Bolivia. This beautiful lake, more than 100 miles long, is the most important lake in Peru and the largest inland body of water in South America.

Rivers in the Sierra flow swiftly through deep gorges and over precipitous falls, passing centers of population in fertile valleys. The Incas carefully terraced the steep surrounding slopes and cultivated the land, supporting a population greater than the region now has. On these terraces they grew their potatoes.

A variety of cereals, vegetables, and fruits are produced in the Sierra, varying from tropical crops in the low valleys to the crops suitable to high altitudes and low temperatures on the plateaus and in high valleys. Corn and potatoes grow in this area.

The Montaña

The territory east of the Andes Mountains, known as the Montaña, is larger than France and England combined. Much of this territory is relatively low and sparsely settled, and has heavy rainfall and high temperature. Although this territory is the largest of the three regions in Peru, it is the least populated, containing less than 10 percent of the total population of the country. With the exception of Iquitos, the most important river port, with a population of 40,000, there are few large settlements throughout the territory.

The Ríos Marañón and Ucayali with their tributaries flow through the Montaña, forming the greatest part of the western fringe of the Amazon system.

The Río Ucayali unites with the Río Marañón south of Iquitos and becomes the Amazon River. Rubber is grown in this area and government rubber nurseries have been established as far up the Huallaga as Tingo María. Some cotton and tobacco are grown in the area around Iquitos. Brazil nuts, mahogany, and other hardwood timbers are found in scattered localities throughout the region.

The Río Ucayali furnishes transportation to, and drains a large section of, the Montaña. A new highway, which is a continuation of a highway already completed from Lima to Tingo María, is under construction from Tingo María to Pucallpa on the Río Ucayali. This highway furnishes the first direct transportation route across the continent—from Lima across the Andes to Pucallpa, and by way of the Río Ucayali to the Amazon and on to the Atlantic Coast.

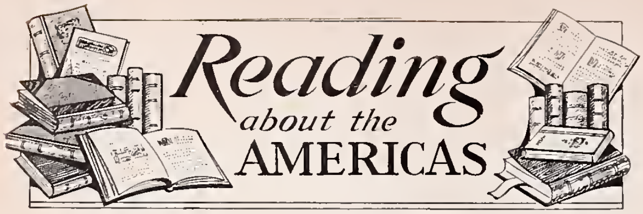
In the southeastern part of the Montaña the Río Madre de Dios is the principal river. It flows into the Río de Beni, which joins the Río Madeira, the largest tributary of the Amazon.

Agricultural products of the region consist of some fiber crops, a little rice and other subsistence crops, coca, coffee, and cacao, but in the Tambopata Valley is found the richest source of cinchona in the country. Rubber trees are found here and forest products are important.

Conclusion

The rivers of Peru have always played an important part in the agricultural and industrial development of the country. They have furnished water for irrigating many acres of fertile land which would otherwise be desert. For industrial use they have a high potential hydroelectric power, Peru is making extensive plans for developing the natural resources of the country, including the construction of one of the largest hydroelectric power plants in South America, the development of anthracite-coal reserves in the Santa Valley, estimated at 10,000,000 tons, and an irrigation project to bring water to thousands of acres of arid land.

In many localities the rivers have been the principal means of transportation and will continue to be important as the transportation system of the Amazon develops.



The Green Continent, a Comprehensive View of Latin America by Its Leading Writers, selected and edited by Germán Arciniegas (translated by Harriet de Onís and others). 533 pp. Alfred A. Knopf, New York; 1944. This is a collection of selected passages from some of Latin America's foremost writers of all times, affording an insight into psychology which would be difficult for those not speaking the languages of those countries to obtain in any other way.

Instruções para a cultura dos eucaliptos, by Luiz Simões Lopes. 33 pp., illus. Serviço de Informação Agrícola, Ministério da Agricultura, Rio de Janeiro, Brasil; 1944. Third edition. The author gives charts showing the uses of eucalypti, lists of species suitable for various locations, and detailed instructions in Portuguese for making seedbeds, starting and transplanting the trees, with the various planting systems.

Argentina, Profile of a Nation, prepared for the Office of the Coordinator of Inter-American Affairs, Washington, D. C.; 1944. Pages not numbered. A short exposition of history and present-day backgrounds of Argentine life, liberally sprinkled with pictographs. Similar booklets are available for Bolivia, Brazil, Chile, Colombia, Cuba, Ecuador, Guatemala, Haiti, Honduras, Mexico, Peru, Uruguay, and Venezuela.

Informe sobre cultivo de maíz en el Uruguay, by Norman P. Neal. 56 pp. Administración Nacional de Combustibles Alcohol y Portland, Montevideo, Uruguay; 1944. At the request of the Uruguayan Government agency of Fuels, Alcohol, and Cement, Dr. Norman P. Neal, of the University of Wisconsin, made a study of corn production in Uruguay. Part I of this book contains, in Spanish, the report of that study, with suggestions for the improvement of the industry. Part II discusses agriculture in general in Uruguay. Part III explains the organization and activities of the Wisconsin Experiment Station and Agricultural School instruction, research, and extension, with the suggestion that Uruguayans may find therein some basic ideas which can be applied to their agriculture.

Rubber. 31 pp., illus. The Pan American Union, Washington, D. C.; 1944. This is a late addition to the series of publications *American Commodities.* It contains a history of the natural rubber industry—hevea, castilla, guayule, and cryptostegia—in the different republics and discusses the markets, the Inter-American Rubber Development program, the prospects for post-war and synthetic rubber.

Noçoes práticas de enxertia, by Geraldo Goulart da Silveira. 65 pp., illus. Serviço de Informação Agrícola, Ministério da Agricultura, Rio de Janeiro, Brasil; 1944. This book contains detailed and well illustrated instructions in Portuguese on the various methods of grafting and budding, with tabular guides to the grafting of fruit trees and ornamentals.

Editor's Note.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

LIVING FENCE POSTS IN CUBA

(*Continued from page* 35)

portant one, is that this type of fence needs little attention other than pruning since the living post gradually grows over and around the wire until it is imbedded in the wood and held firmly.

Trees to Serve Another Purpose

Of a total of 20 or more different species of plants used for living fences in Cuba, only 2 produce a potentially commercial product. The seeds of *palo jeringa* (*Moringa pterygosperma*) produce a medicinal oil known locally as *aceite de Ben.* The cashew nut tree (*Anacardium occidentale*), in addition to containing large amounts of tannin, produces a resin which is incorporated in glue as an insect repellent used in book binding. Neither of these products, however, is at present collected commercially in Cuba.

Some of the more progressive people have considered the possibility of using other trees which would bear products of real economic importance. *Aleurites trisperma,* the soft lumbang oil tree, which produces in its seeds a valuable drying oil, has been suggested for this purpose but so far it has never been tried in Cuba. No doubt, there are numerous trees which would yield some product remunerative to the farmer and which could at the same time be used satisfactorily for Cuba's "living" fence posts.

AGRICULTURE IN THE AMERICAS O. R. CARRINGTON, EDITOR

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Gifts of the Americas

LIGNUMVITAE

by BEATRICE DU FRANE

Tales of the remarkable curative powers of the *guayacan* tree, told him by natives of the West Indies, fired the imagination of the Spanish explorer, Gonsalvo Ferrand, when he visited that area not long after the discovery of America. On his return to Europe with a few logs, stories of the reputed value of *guayacan* made it instantly popular. Renamed lignumvitae, the "Wood of Life," by Europeans, it was considered a remedy for a multitude of diseases, ranging all the way from palsy to leprosy.

Since 1508 lignumvitae has been an article of commerce. As early as 1517 medical treatises began to appear, extolling the virtues of its resin. The value of the wood soared until for a time one pound brought as much as seven gold crowns in Spanish money. Not until two centuries had passed did scientists seriously question its curative powers. Today lignumvitae is little used in drugs. Since its discovery, however, the wood has also played an important part in the ship-building industry, and it is in this capacity that lignumvitae is most valuable today.

Lignumvitae belongs to the family *Zygophyllaceae.* The name, *guayacan,* from which the generic botanical name, *Guaiacum,* is derived, is an Indian word. Several species exist, but the true lignumvitae of commerce comes mainly from *Guaiacum officinale L.* and *G. sanctum L.*

Native to the tropical and subtropical regions of the Western Hemisphere, lignumvitae is found in the West Indies, the North Coast of South America, Central America, and Mexico. One of the Florida keys is known as Lignumvitae Key, because at one time the tree grew there.

Squat, round-headed, gnarled, with compound leaves about 4 inches long, the tree reaches approximately 30 feet in height, and averages about a foot in diameter. The bark of *Guaiacum sanctum* is rough, that of *G. officinale* smooth. Three or four conspicuous blue or purple flowers grow at the ends of the branches. The small, orange-colored fruit contains black seeds within a scarlet coat.

With an oven-dry weight per cubic foot averaging between 75 and 80 pounds, lingnumvitae is one of the world's hardest and heaviest woods, and is also one of the most cross-grained. The yellowish sapwood is narrow in *Guaiacum officinale,* wide in *G. sanctum.* When logs have lain on the ground or in water for a long period, the sapwood may be entirely removed by decay. The heartwood ranges in color from olive brown or greenish to almost black. A fine-textured wood, lignumvitae is oily or waxy to the touch, low in luster, somewhat acrid to the taste, and pleasingly scented when warmed or rubbed.

From the tree is extracted a reddish brown resin known as *guaiac* or *guaiaci* resin, the reason for lignumvitae's former prominence in the field of medicine, and still in some demand by the drug trade. When the living tree is injured, resin forms over the injury in exudations known as "tears" and may be collected in this form. It may also be obtained from sawdust or woodwaste by the use of alcohol or ether, or by boiling chips or sticks in water. Acting as a natural lubricant and preservative, this resin accounts for much of the wood's commercial value.

The combination of self-lubrication, great resistance to friction and wear, remarkable hardness and density, makes lignumvitae ideal for certain purposes. Its principal use is for bearings or bushing-blocks for propeller shafts of ocean steamships. It supports the tremendous weight of the propeller and propeller shaft and resists the enormous side pressure of the propeller shaft, all without artificial lubrication. Reports indicate that lignumvitae lasts from 3 to 7 years in this exacting capacity, serving almost three times as long as steel or bronze.

In addition, lignumvitae is employed in the shipbuilding industry for dead-eyes, bull's-eyes, and collars of rope guides. It is also manufactured into bearings for water turbines, where its natural lubrication is a decided asset. Used for pulley sheaves, lignumvitae has been reported in good working condition for more than 50 years. Mallets, caster wheels, masthead trucks, chisel blocks, cable dressers, stencil and watchmakers' blocks, mortars, pestles, brush backs, dowels, wooden cogs, block guides for band saws, and turned novelties are made of lignumvitae. In steel and tube mills the wood satisfactorily replaces brass and babbitt metal for bearings in pumps and roller mills. It is less expensive for this purpose, outlasts metal, and needs no lubrication.

This hard, strong wood, with its multitude of uses, is a gift of the Americas that has been of commercial importance for more than four centuries.

THE RIVER BASINS OF PERU

by **Ruth Parker Schottroff**

The rivers of Peru are as diverse and colorful as the land across which they flow. The wide variety of geographic, climatic, cultural, and economic factors makes this country truly a land of contrasts. Located in the tropics, possessing a wide range of altitude, with fertile valleys and plateaus at different elevations, and extending over 482,258 square miles from the equator to below 18° S., Peru is really a favored country.

The total population of Peru in 1940 was about 6,208,000 and the density per square mile varied from less than one person in the Department of Madre de Dios to nearly 6,000 in the Department of Callao. Peru is divided into three distinct regions.

The Coastal Region

The coastal region extends from Ecuador to Chile, a distance of over 1,400 miles. It averages approximately 30 miles in width and consists of a series of desert plains and hills interspersed with many river valleys. Though well within the tropics, the temperatures of the irrigated coastal valleys are not excessively hot, and, as in most desert areas, vary greatly from day to night.

Over 50 rivers flow across these coastal plains, only a few of which have sufficient volume of water to reach the Pacific throughout the year because of intermittent rainfall and diversion of the water for irrigation. The Tumbes and Chira are the only rivers entering the Pacific which are navigable for even a short distance. However, some irrigated land is found in each of the valleys where many different subsistence crops are grown, including rice, corn, legumes, wheat, barley, and alfalfa. Over half of the agricultural capital of Peru is believed to be invested in these irrigated farms, and about 50 percent of the agricultural income is derived from them. Activities dependent upon irrigation furnish half of the entire national income. Cotton and sugarcane are the principal commercial crops. Cotton is grown in practically all of the valleys with the heaviest production in the Rimac, Ica, and Piura river valleys. Sugarcane, one of the largest commercial crops in Peru, has its heaviest acreage in the valleys of the Chicama, Lambayeque, Chancay, and Nepena rivers.

Some of the rivers have great potential hydroelectric power, like the Río Santa, which rises high in the Andes, cuts its way through solid granite forming a canyon nearly 8 miles long and several thousand feet deep, and drops 1,400 feet in elevation within a distance of 5½ miles.

The Sierra or Mountain Region

The Sierra region of Peru consists of three chief mountain ranges: the Maritime, an unbroken range in the west, extending the entire length of Peru; the Central Cordillera, a shorter broken range running parallel to, and near, the Maritime in the northern half of Peru; and the great Eastern Cordillera. Many plateaus and valleys lying at various levels are in the

(*Continued on page* 39)

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March 1945

NAMES & NEWS

Panamanian To Study Here

Señor Juan Rivera, Chief of the Section of Agricultural Economy of the Panamanian Ministry of Agriculture and Commerce, arrived in this country recently to pursue special courses under the sponsorship of the Department of Agriculture. Señor Rivera will be particularly concerned with preparation for a forthcoming census of Panamanian crops and livestock.

●

Returns to Guayaquil

John J. McDermott, Biochemist, Office of Foreign Agricultural Relations, has returned to the Cooperative Agricultural Experiment Station at Guayaquil, Ecuador, where he is in charge of a laboratory that is carrying on research in connection with the program for increasing the production of strategic complementary crops.

●

Extension Director Tours Latin America

Aubrey Gates, Associate Director of the University of Arkansas Agricultural Extension Service, has been making a tour of seven Central and South American countries under the sponsorship of the Department of State. Mr. Gates is making a study of farming conditions and Extension education in Latin America.

●

Assigned to Salvadoran Experiment Station

Samuel H. Work, Animal Husbandman for the Office of Foreign Agricultural Relations, has been assigned temporarily to El Salvador, where he will assist in the livestock work at the Cooperative Agricultural Experiment Station. Dr. Work also will consult with agricultural leaders at the National School of Agriculture in Guatemala and the Pan American Agricultural School in Honduras and will visit Nicaragua for the purpose of selecting mules for the Salvadoran Station.

Visitor From Peru

Señor Jorge Alejandro Rose, of the Department of Statistics and Crop Reporting in the Peruvian Ministry of Agriculture, is visiting the United States as a guest of the U. S. Government. Señor Rose will study methods of crop reporting in this country.

●

Working With Hevea

Richard Evans Schultes, of the U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering, has returned to South America, where he will continue work on a special project which includes the investigation and collection of various species of wild hevea rubber in Colombia, Bolivia, and other countries of the Amazon region. Dr. Schultes was recalled to Washington recently to report on the progress of this work and to complete a taxonomic study of various hevea species at Harvard University.

●

Returns to Tingo María

Bowen S. Crandall, Pathologist for the Office of Foreign Agricultural Relations, has returned to Peru, following conferences in Washington. Mr. Crandall is on the staff of the Cooperative Agricultural Experiment Station at Tingo María, where he is conducting a series of studies relative to the development of the cinchona industry, with special emphasis on the determination and behavior of disease-producing fungi. Mr. Crandall also assists with the selection of high-alkaloid disease-resistant trees to be used for propagation purposes.

●

To Investigate Bamboo

Floyd A. McClure; Botanist for the Office of Foreign Agricultural Relations, will spend the next year in the West Indies and in Central and South America, where he will visit various experiment stations and industrial developments with a view to investigating the possibilities of developing bamboo as a complementary crop, particularly in those countries where collaborative programs have been established. Countries which Dr. McClure will visit include: Cuba, Jamaica, Trinidad, Canal Zone, Ecuador, Peru, Costa Rica, Nicaragua, Honduras, El Salvador, and Colombia.

Agriculture IN THE *Americas*

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Costa Rica—Land of Forests

Possessing an area smaller than West Virginia, Costa Rica has an arborescent flora richer than that of the entire United States and Alaska. Although Costa Rica has long been a mecca for botanists, the country's forest resources are still largely unknown.

by WILLIAM A. DAYTON

Of all the Central American republics Costa Rica is perhaps the most interesting to the naturalist, botanist, and forester. Guatemala has the highest volcanic peaks in Central America and the greatest altitudinal variation, but the flora there is essentially North American. Honduras and Nicaragua have sparser populations than Costa Rica and, to that extent, are wilder, but neither of these countries, and especially the latter, appears to possess those extraordinary local variations in floristic conditions and types which characterize Costa Rica. It is noteworthy, also, that pine forests—arboreal indices of the Northern Hemisphere—stop abruptly in Nicaragua and do not occur in Costa Rica or southward into South America.

Costa Rica, for more than a century, has been a paradise for botanists and naturalists from many parts of the world, including a number of eminent native Costa Rican scientists. It would seem, therefore, that so relatively small a country would now be thoroughly explored, but such is not the case. The botanizing has largely been confined to the inhabited portions, about one-fourth of the country, whereas the other three-fourths is chiefly a virgin wilderness, where travel is difficult and sometimes all but impossible.

The author is a member of the U. S. Forest Service in charge of Dendrology and Range Forage investigations. He accompanied a U. S. Forest Service party to Costa Rica in 1943 and twice visited the Copey Oak Forest. Mr. Dayton is well known for his publications on native range plants.

Costa Rica derives its name, which means rich coast, from its many gold mines, the fame of which lured the early conquistadores. Yet its forests are, and probably will remain, its chief natural resource. While no adequate forest or ecological survey of the country has been made, an estimated three-fourths of it is still covered with heavy first-growth forest, although the settlement of the country began four and a half centuries ago.

Rich Arborescent Flora

Although possessing an area less than that of West Virginia, Costa Rica has an arborescent flora that is richer than that of the entire United States, including Alaska. Standley's *Flora of Costa Rica,* the only modern manual for any Central American country, lists over 1,000 species of trees belonging to 97 families and 394 genera. This list does not include tree ferns. The latest U. S. Forest Service check-list of native and naturalized trees of the United States and Alaska gives 1,015 species and 167 varieties of trees belonging to 79 families and 255 genera.

Some understanding of the lack of complete information on Costa Rica's forest resources may be gained from a single experience of a field party of the U. S. Forest Service of which the writer was a member. At one small Costa Rican lumber mill it was found that 35 different kinds of trees were being sawed into lumber. Investigation showed a startling lack of scientific knowledge about them. At least three of the species concerned, and these were important ones, were new to science, and of these one family and two genera had not previously been known in North America. Another species had never before been collected in Costa Rica. Still another had been known only once

Map prepared by William R. Barbour, U. S. Forest Service, showing the five main forest areas of Costa Rica.

before in any country. Three others are still puzzling the botanist to whom they were sent; he is not sure of the genus of any of them nor of the family of one of them, although in two cases he has tentatively suggested a possible generic name.

Some of the more important Costa Rican tree families include: The legumes (Leguminosae), the madderworts (Rubiaceae), which include coffee and cinchona; melastomes (Melastomaceae), which are represented in the United States by the attractive little herbaceous meadow-beauties known as *Rhexia* spp; the mulberry-fig family (Moraceae); laurels (Lauraceae), important in the lumber industry; mahogany family (Meliaceae), from which come mahogany and Spanish-cedar, Costa Rica's two most valuable woods; linden family (Tiliaceae); and sapote-sapodilla family (Sapotaceae). There are only two native conifers in Costa Rica, both of which are podocarps. No pines are to be found in the country except those specimens which have been cultivated as ornamentals.

Geographically the forests of Costa Rica are divided into five main types, of which the Evergreen Rain Forest is the most extensive and characteristic. The other forested areas, in the order of their importance, are the Deciduous Forest, Cloud Forest, Mangrove Swamp, and Palm Swamp.

Evergreen Rain Forest

The Evergreen Rain Forest occupies nearly 12,000 square miles of territory or more than 60 percent of the entire area of the country. It is located in a region having a heavy and fairly well distributed rainfall of from 118 to 236 inches per year. Nearly 87 percent of the forest is in a virgin state or practically so.

The vegetation in this type, which extends from near sea level to the lower limit of the Cloud Forest type, is particularly luxuriant. Here occur the great majority of the tree species of the country and, with the exception of the unusual oak forest of the Cloud type, the heaviest timber stands and the largest trees. The distribution of the different species is "spotty" rather than in almost pure stands or in simple mixtures as in this country. Seldom do more than a few individual trees of the same species occur to the acre, and in adjoining areas, where growth conditions appear, superficially at least, to be identical, the same species is absent. The plant growth is in at least four stories. The dominants, or tallest trees, form what is practically a canopy over the rest of the forest. Below the tallest trees is a second story of tolerant, medium-size, and frequently lauraceous trees. Farther down is a third group of small trees, in which melastomes, tree ferns, and palms often predominate. Finally at the bottom is an undergrowth composed of numerous herbaceous plants such as begonias and peperomias, a wide variety of shrubs, chusqueas and other bamboos.

The trees of the Evergreen Rain Forest are covered with epiphytes and festooned with huge lianas of figs and other species which give an effect of almost infinite complexity. The forest is dark on the sunniest days and, to the visitor from the North, presents a somber and somewhat foreboding aspect. One of the best descriptions is that given by Standley. He says: "Entering the forest on foot or on horseback, the first feeling is one of bewilderment. One recalls the old remark about being unable to see the forest for the trees. . . . All the branches of the trees are so high overhead that one can form no idea of their foliage, especially because the branches of adjoining trees are interlaced, and even when leaves float down from their branches one never can be quite certain of the tree to which they belong. The only means of identifying these tall trees is to see them cut. Then it is revealed that they are astonishingly diverse as to species, and that pure stands of one species never, or very rarely occur."

In spite of the density of the growth and the interlacing of vines and epiphytes some of the trees may be identified through distinctive bark characteristics. The native Costa Rican woodsman is astonishingly proficient in identifying

trees by the "machete method," chopping into or blazing the tree and naming it vernacularly by color, odor, taste, and other characteristics of bark, sap, and wood, and is often a more competent field dendrologist than the more professional forester.

Although no adequate catalog of the Evergreen Rain Forest can be given here, in addition to mahogany and Spanish-cedar, some of the more important trees are: Bolador *(Persea austin-smithii)*; campana *(Laplacea spp.)*; cenícero, which is sometimes called raintree saman *(Samanea saman,* syn. *Pithecellobium s.)*; chancho colorado *(Vochysia sp.)*; colorado *(Nectandra concinna)*; comenegro *(Hieronyma oblonga)*; cristóbal of the macawood genus *(Platymiscium pinnatum)*; gavilán, a name applied locally to the curiously wing-fruited walnut relative *Engelhardtia pterocarpa* and also to the mimosa-like representative of the owala-oil-tree genus, *Pentaclethra macroloba;* guayacan *(Sweetia panamensis);* ira chiricana *(Vantanea barbourii)*; laurel, pronounced laurél, which is onion cordia *(Cordia alliodora)* and no relation to true laurels; manú *(Caryocar costaricense)* of the commercial sawarrinut genus; maría *(Calophyllum brasiliense rekoi)* of the beautyleaf genus; pejiballito *(Chimarrhis parviflora);* pilón *(Hieronyma alchorneoides)*; quizzará *(Nectandra spp.)* and tirra, or Mexican elm *(Chaetoptelea mexicana,* syn. *Ulmus m.)*.

When the rain forest is cut over, the first timber to invade the area is usually such light-seeded and relatively intolerant trees as balsa *(Ochroma spp.)*; burío *(Heliocarpus spp.)*; capulín *(Muntingia calabura)*; cedro, or Spanish-cedar *(Cedrela spp.)*; *Ceiba* spp.; and guarumo, or pumpwood *(Cecropia spp.)*.

Deciduous Forest

The Deciduous Forest, which is confined to the Pacific side of the Cordilleras of Guanacaste and Talamanca, is the second-most-important forest area in Costa Rica. It embraces an area of more than 2,500 square miles, or approximately 13 percent of Costa Rica's land surface. About one-fourth of the area has been cleared for farming or pasture and nearly all of the rest has been culled. The region has less rainfall than the Rain Forest and there are definite wet and dry seasons. Little rain falls from December to April and during this period the trees lose their leaves, not to put forth a new crop until the rains start again in the spring.

The mahogany and Spanish-cedar of the Deciduous Forest are considered to be of a much higher quality than those of the Evergreen Rain Forest and command a better price. Except along streams the trees of this forest are short-boled, though often large in circumference. The composition of the forest is simpler than that of the Rain

Tropical Rain Forest along the Río Reventazón below the Turrialba bridge, Cartago Province.

Forest and is often one-storied except for the herbaceous and scrubby ground cover. Coyol palms are common and usually are left standing when the forest is cleared.

In addition to mahogany, cocobolo *(Dalbergia* spp.*)*, and cedro, the more important species of the Deciduous Forest include: corteza *(Tabebuia chrysantha)*; espavel, a cashew relative *(Anacardium excelsum)*; guachipelin *(Diphysa robinioides)*; guanacaste *(Enterolobium cyclocarpum)*, the mimosaceous species of earpodtree from which the Province of Guanacaste derives its name; mora *(Chlorophora tinctoria)*, known by us as fustictree; nance *(Byrsonima crassifolia)*; pochote *(Bombacopsis fendleri)*; roble-de-sabana *(Tabebuia pentaphylla)* of the trumpettree genus; and ronron *(Astronium graveolens)*, startree genus.

The first trees to invade Deciduous Forest land after it has been cleared are those having light, air-borne seeds, such as the Spanish-cedar, ceiba, corteza, roble-de-sabana, and balsa. Following these are the legumes and fleshy-fruited species whose seed are distributed by birds and other animals. The balsa wood of the Deciduous Forest is generally heavier and of poorer quality than that grown on the Atlantic side of Costa Rica.

The finest Spanish-cedar growing on the Pacific side of Costa Rica is denser, finer-grained, better-colored, more highly scented, and higher-priced than the evergreen "cedro" of the Atlantic Coast.

One of the weirdest and most interesting tree areas is that composed of Copey oak in the Cloud Forest.

Cloud Forest

There is no sharp line of demarcation between the Evergreen Rain Forest and the Cloud Forest, which is sometimes called the Upland Rain Forest. In many respects, however, the Cloud Forest is the most extraordinary forest type in Costa Rica. Cold, wet, and misty, it begins at about 6,500 feet in the high central Cordillera de Talamanca and follows the crest of the mountains beyond the border of Panama. It covers about 750 square miles or slightly less than 4 percent of Costa Rica's area. Until the Inter-American Highway recently pushed into this area, the Cloud Forest was practically unknown. It is still almost wholly unexplored. The outstanding feature of this type is the weird and "spooky" Copey oak forest which has been already described in an earlier article.*

Mangrove Swamp

This minor forest type is confined to narrow belts and patches along the Atlantic and Pacific coasts and their tidal estuaries. Most important species of trees found in the Mangrove Swamp are the mangle or American mangrove *(Rhizophora mangle)*, mangle negro or button-mangrove *(Conocarpus erectus)*, and "palo de sal", a term applied to the black-mangrove *(Avicennia nitida)* and to false-mangrove *(Laguncularia racemosa)*. Although little economic use is now made of these species, except for the production of charcoal, they possess considerable potential value in the development of a tanning industry in Costa Rica.

Palm Swamp

The Palm Swamp type is confined to the fresh or brackish swamplands which extend along the Atlantic Coast from the Nicaragua line south to Puerto Limón. It covers approximately 155 square miles or less than 1 percent of the total area of the country. There are few dicotyledonous trees in the dense growth of these Palm Swamps but more than 90 species of palms are to be found there. In view

(Continued on page 58)

*See AGRICULTURE IN THE AMERICAS, July 1944.

Indian Gardening in El Salvador

The Indians living on the steep hillsides of El Salvador have been raising "Victory Gardens" for centuries—real victory in the sense of subsistence—and suiting their methods to the peculiar conditions under which they live.

by FREDERICK L. WELLMAN

On the hillsides and in the hot upland valleys of El Salvador, the use of many of the approved gardening methods successful in Europe and the United States of America would be manifestly impossible. The Indian, however, has gardened here under difficult conditions for countless years and has solved for himself many of his gardening problems. Here, on the poor or fair soils, under the alternating severe conditions of the rainy and dry seasons, he has produced his food, without money outlay and with the most meager of native tools. Moreover, he has learned to do it as a matter of course and has even developed with it a primitive soil science.

The Indians whose work I have studied live high up on the sides of volcanoes, in deep valleys among the mountains, or on lands so steeply tilted that moneyed owners would find them unprofitable for cultivation. The soils are thin and of comparatively recent volcanic origin. When laid bare, they wash away like lumps of sugar.

The gardens are located far from the larger markets. When the time of greatest harvest arrives, the products must be brought to the centers of trade, either in oxcarts over ragged roads, or by foot, carried in broad flat baskets on the superbly upright heads of women, along many a weary mile of primitive footpaths. A long file of these women, in their ankle-length, ruffled, pastel-tinted dresses, with contrasting scarfs of many delicate shades gracefully draped across their shoulders or sweeping down from about their faces, and balancing on their heads piles of handsome, bright-colored produce, is a sight not easily forgotten.

There are two seasons in El Salvador: The dry summer, or *verano,* that generally lasts from some time in November to the latter part of April, and the wet winter, or *invierno,* which extends throughout the rest of the year.

When the rains stop, it is like closing off a faucet, with only a few drops squeezed out 2 or 3 times during the next 6 months. The plants shrivel under the blazing sun, and seedlings no longer emerge. Trees and shrubs, which have long been waiting, blossom hurriedly as if to take advantage of pollination by the now abundant wild bees that have gone on multiplying, unbeaten by the rains. Then everything settles down to the long pull, until the rains come once more. This period of quiescence affects even the plant-attacking diseases.

When the rains begin again, it is like turning the sprinkling system on full force. Rain falls every afternoon and night, with only occasional rests of a few days. The thirst of the powdery land is quenched, the leaves are washed free of the heavy dust and begin to "breathe" again, and seeds that have dropped in the soil swell and burst into growth. Certain plants of the forest floor blossom delicately, the ferns and mosses uncurl, liverworts grow over the wet rocks and volcanic slag or tuff, and the fungi resume their parasitic devastation.

Delicate seedlings are started in a seedbed supported on stakes. The bed is placed in the shade of a tree and is protected from rains by a woven mat held by stakes along the edge of the bed.

The *invierno* (rainy season) closes in dramatic force. The gusty storms called *temporales* lash with beating rain, wind, thunder, and lightning. The plants and trees are drenched

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Mr. Wellman is Senior Pathologist and Assistant Director *Centro Nacional Agronomía* of El Salvador. The author is indebted to Padre Anton Kovar for his assistance in supplying important data for this article.

Cucumbers grown in a bed covered with trash blanket.

and bruised. It is a wet time indeed. And then the water is "turned off."

Seedbeds

The Indian gardener knows all this and makes plans for his young plants accordingly. He puts his seedbed in a sheltered spot where he can give it daily care. One type is truly a bed, in the sense that a platform is built on stakes, a layer of moss and trash is laid on the platform, and on top of that is placed the best crumbled soil. It is watered by hand, and covered at night and during the rains by a slanted, woven mat.

The other type is the usual finely worked, raised-ground bed. It has low walks and drainage ditches on all sides and is often edged with bamboo or other sticks to keep the soil in place. Seeds are, for the most part, sown in rows and frequently in between the rows are laid coverlets of cut grass or tree leaves to "keep the soil cool." All seedbeds are tended with great diligence, and the seeds themselves, no matter how small, are handled individually and almost with reverence during the planting process.

The type of seedbed chosen depends upon the topography of the land and the various sources of danger to the seedlings. A moderately flat bit of land may lend itself to ground beds, whereas on a steep hillside where the earth washes readily the stake bed is preferred. The gardener realizes that assiduously tended beds on stakes give protection from damping-off diseases, mildews, leaf-cutting ants, grubs, wild animals that sally at night from the adjacent bushland, and even the pigs and small children of the neighboring thatched huts or *ranchos*.

But the Indian's gardening intelligence does not stop with the seedbed. If it did, he would starve; his food does not bounce out of the ground or pour out of the trees as it is wont to do in the fairy-tale Tropics. He must study carefully the field where he plans to put his crops, with practiced eye size up his individual situation, classify his soil as to character and cultural adaptability, and then work it in the fashion approved by ages of trial and error.

Basic Indian Soil Science

The pattern which the Indian follows in handling his land is dependent upon a relatively organized and scientific point of view. This is indicated by a well-established soil nomenclature. A soil *(tierra)* is *buena, mediana,* or *mala* according to whether it is good, moderately good, or of poor quality as judged by production. Soil which is on a slope is called *terreno de ladera;* if on top of a rounded hill, it is *hoyada*; and, if it is the rich alluvium of a flat river valley, it is *de vegas or vegas.*

Again, soil may be classified according to the means best suited for planting. If the primitive ox-drawn wooden plow is to be used, the soil is *arrada*; it is *chuzo* when the ground is hard and requires the use of a sharpened, heavy, spade-like blade set in a strong handle; and it is *de macana* when the earth is soft, friable, and easily washed and planting must be done with the minimum of disturbance. For planting in *de macana* soil, the *macana* is used—a rod that has a fire-hardened tip or a sharp stone or iron set in the end. These three kinds of soil are well drained. If the land is such that it remains moist from seepage during the dry season, it is known as *chahuital.*

Planting Practices

The Indian shows great intelligence also in the way he prepares his land and plants it. If the land is covered with high bush or forest, he cuts the trees and removes the

Corner of a typical Indian garden. Note mixed culture: In front, potatoes just dug and trash scattered over replanted ground; next, a few manioc plants left for multiplication; row of pineapples, with volunteer bean plants scattered between; tomatoes behind the pineapples; and, not shown in picture, at back were beans and corn.

usable logs or stakes. He does not remove the low stumps or disturb the roots but makes the holes for planting by means of the *macana* and pushes the soil over them with his foot. This type of handling is called *roza gruesa.* Under certain conditions the fine brush and the leaves are allowed to dry and are then burned. This is said to fertilize the soil, make it softer, and to kill diseases and insects.

If burning seems inadvisable because the soil may wash badly, the fine brush is flattened on the ground and rolled into a *carrileo* as if it were a carpet. The uncovered ground is planted and the *carrileo* rolled back over the newly seeded part. This process is repeated until the plot is all planted and a thin blanket of debris is evenly distributed over the seeded land. When the rains come, this trash blanket starts to decay, weeds are clipped off above the soil line, and soon the crop is in full growth. In some places the Indians chop weeds and debris into the upper layers of the soil about the roots of the plants to prevent washing.

If the field is located on a gentle slope and has been cleared and cultivated the year before, it is called *guatal.* In this case, unless the land washes seriously, the debris is burned with some formality. The bushes, weeds, and grass are cut off at the ground line and a bare space is swept clean around the edges of the field for a fire guard. The width of this bare space varies in different districts but must comply with the local ruling. Permission must be obtained from the chief magistrate or *alcalde,* sometimes at the cost of a small fee governed by law. The neighbors are all given notice of the burning and it is allowed only during a definite period called *quema,* the 2 months just before the rains begin. During those months the countryside remains in a shroud of the gray smoke of burning brush.

Sometimes a *guatal* that does not wash badly and is reasonably free from large stumps and roots may be plowed after *quema.* The wooden plow that is used digs a rut but does not turn the soil under. The first plow marks are run close together, called *arar,* and to prepare the field more thoroughly the plowing is then done crosswise, *cruzar,* of the first work. After that the ground is again plowed deeply in the direction of the first plowing in order to *hacer surcos,* meaning that the furrows are prepared. Planting is done by hand along these furrows and the seeds are covered with the foot.

The methods of seeding are interesting in their adaptation to the particular situation. In plowed land that does not hold the moisture well the seeds are planted *en surco,* in the bottom of the furrows. If this method is believed undesirable because the soil is too moist or because diseases are apt to attack the plants, flattened ridges, *camellones,* are prepared and seeds planted on top of these. Sometimes the soil is such that it must be hilled up around the plants,

Courtesy of Padre Anton Kovar

Planting with a *macana* or iron-pointed stake.

and this is spoken of as *aporcar.* If danger from erosion is great, seeds may be sown in grouped hills, one hill in the center with four equally spaced about it. This method is called *en cruz* and is a common *macana*-planting arrangement in thin soil. In some gardens seeds are sown in *regadío* or *voleo,* which means simply scattering the seeds irregularly under the trash blanket system of culture.

One of the impressive features of the Indian gardener's work is that he uses a minimum amount of seed. This may be a reflection of his economic condition. In any case, the meager seedings often result in poor stands and even crop failure. Wherever the frequent gaps in his planting occur, the gardener puts in other vegetables, so that no soil will be left bare, and volunteer plants of any food value are carefully cared for where they stand.

Apparently, little fertilization is employed. The Indian relies more on the natural process of rejuvenation and recovery of his soils than on amendments through addition of fertilizing elements. It suits his economy and habits to follow a shifting method of cultivation by which the land rests every so often. A plot is allowed to grow up into weeds, bush, and trees to regain its productive capacity, and it then is recleared after a few years to again produce his food.

These gardening practices are closely related to the Indian's diet as well as to the physical characteristics of the land which he works. He has two staffs of life—one, the flat, crisp, and fragrant maize cake or *tortilla,* the other his pot of well-cooked paste or puree of black or of red beans, his beloved *frijoles.* He employs many variations in cooking these staples, but they are always the main part of his meal.

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Irrigated alfalfa fields near Arequipa provide extensive pastures for livestock.

Crop Pests of Coastal Peru

Eternal vigilance is necessary in combatting the insect pests which endanger crops. This is as true in Coastal Peru, where irrigation has transformed desert into fertile oases, as in other parts of the world.

by **PAUL KNIGHT**

In a biological and geographical sense Peru is not one but three countries, each divided sharply from the others by climate and altitude. Transitions are sudden—fertile oases become desert a few feet above the level of irrigation canals, and flat valleys break into steep mountains within the length of a Victory Garden.

In the smallest of these three divisions, the coastal plain, the North American entomologist will find many familiar crop pests. In the desert which makes up a large part of the coastal area, conditions approximate those found in many sections of western United States, the principal difference being that in Peru they are on an exaggerated scale, the dry parts much drier. It is easy to recognize the sugarcane borer (*Diatraea saccharalis*) in the cane fields at Paramonga and Chiclín, or the cotton boll perforator (*Heliothis virescens*) in the cotton plantings at Pativilca, though the latter is known to entomologists in the United States as the tobacco budworm. Corn and tomatoes in Peru are injured by the corn earworm or bollworm (*Heliothis obsoleta*), and most of the scale insects attacking tropical fruits in the Camaná Valley are familiar to horticulturists in Florida and California.

The agriculture of Coastal Peru has developed in units of large haciendas. Entomological research has moved in much the same pattern, and, while there has been considerable observation of the pests of various minor crops, many of the significant contributions deal with the pests of cotton and sugarcane, which are the two most important crops of the coastal haciendas of Peru.

The Coastal Plain

The coast line is approximately 1,400 miles in length, a distance roughly equal to that from Boston to Miami. Extending the entire length of the coast is a narrow coastal desert, never more than 50 miles wide and for long dis-

tances almost as narrow as the ocean beach itself. Here rain almost never falls, and over a large part of this expanse there is not a sign of plant or animal life. Only in the areas where the persistent fogs come in from the Pacific and are trapped by mountains close to the shore is found a sparse vegetation growing naturally.

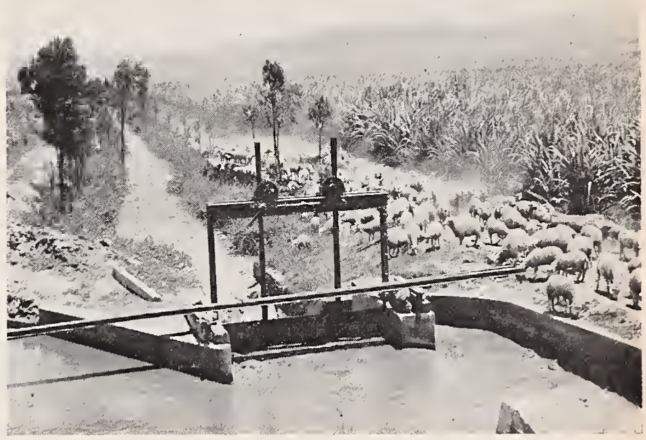
Yet in spite of the fact that not more than 4 percent of Coastal Peru is capable of cultivation, the area is vital to the economy of the nation, producing about half of the entire exports of the country. This is possible only because of irrigation. Some 50 rivers, watered by the snow and rain of the high Andes, rush down the mountain gorges and, when they reach the desert, proceed sluggishly toward the Pacific through this plain. Along the last level miles these rivers are tapped many times to produce oases of varying size, in which much of the agricultural wealth of Peru is produced. Under irrigation, cotton has become king of the coastal valleys, surgarcane the Number Two crop, and since the outbreak of the present war there has been a greatly expanded production of food crops badly needed within the country. In one coastal oasis an important fruit-growing belt is developing and in another high-quality wines are made. In two or three, extensive livestock feeding is practiced.

Pests of Cotton

Cotton planting, though of relatively recent commercial importance in Peru, has become extensive, and some of the highest yields and quality in the world are produced here. In every irrigated valley where cotton grows, the entomologist finds largely the same complex of pests, though conditions are not always the same. Each valley seems to possess its own biological rhythm, conditioned largely by the time and length of the flow of water in the rivers, though climate and other factors also vary. Of the 50-odd oases in the coast area only about 10 have a flow of water through the year, and among the others the time of year and length of flow vary considerably. Thus life histories, seasonal occurrence, and extent of damage are not the same with insects of cotton, cane, or any other crop that grows throughout the length of Peru. Conclusions reached in the extensive cotton fields near Piura in the north will not necessarily hold true for the important Cañete area south of Lima.

A few of the most important insect pests of cotton have been imported, some of them so recently that they are still in process of dispersal. At the present time the most serious insect is known locally as the "arrebiatado," a sucking insect known in North America as the cotton stainer. In addition to cotton this insect feeds on most of the other members of the mallow family and also on the ceiba tree *(Bombax ceiba)*, from the pods of which comes the floss known commercially as kapok, and on closely related plants. Many of these alternate hosts are found on the first slopes of the Andes, from which the insects migrate to the developing cotton during spring. The cotton boll perforator *(Heliothis virescens)* is present in the coastal valleys, where it attacks beans, tobacco, the *garbanzo* or chickpea, and other crops. This insect was the cause of more inquiries than any other during the author's 2-week trip through the northern desert in January 1944. The "pulgón del algodonero" or cotton aphid *(Aphis gossypii)* is serious in most cotton-producing areas and is also a major pest of melons and other cucurbits. The "araña colorado" or red spider *(Tetranychus peruviensis)* is often severe in dry seasons.

A dry season and a wet season in coastal Peru have about the same amount of precipitation, which usually means none. But in normal years the coastal belt has a high relative humidity due to the presence of the fogs that sweep inland from the Pacific. When the humidity drops, the season is considered a dry one.



Without irrigation Paramonga's principal crop of sugarcane would not be able to make the luxuriant growth that is indicated in this picture.

Two species of leaf worms *(Anomis texana)* and *(Alabama argillacea)*, the "gusanos de las hojas" of the cotton planter, are abundant. The former is generally distributed in the cotton-producing areas, the latter is more limited to valleys in the north. "Cigarillas" or "loritos," leafhoppers in English, are prevalent and are gaining in importance as pests. They are of general occurrence throughout the coastal oases and cause considerable injury to beans, peppers, tomatoes, sweetpotatoes, and other garden vegetables. The Mexican cotton boll weevil *(Anthonomus grandis)*, the major cotton insect in the United States, is not present in Peru, although a related but smaller species known as the "picudo peruano" or cotton bud weevil *(Anthonomus*

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vestitus), which attacks the flower buds, is prevalent. Nowhere, however, does its damage approximate that caused by the boll weevil of North America. To date, the pink bollworm *(Pectinophora gossypiella)* has not found its way into Peru, and a sharp watch is being maintained against its intrusion. Although it is impossible to know what the behavior of this species would be in this new environment, its destructive capacity in other irrigated cotton-producing areas of the world is known to the cotton growers of Peru.

Insects Attacking Sugarcane

The principal pest of sugarcane is the sugarcane borer *(Diatrae saccharalis),* a species which also causes widespread injury to rice, sorghum, corn, and wheat. Infestations ranging from 60 to 80 percent of the corn or cane plants in a field were frequently seen. Even where the latter percentage prevailed, however, corn yielded a good crop.

Some years ago the widespread egg parasite *(Trichogramma minutum)* which lives on the sugarcane borer was successfully established in Peru, and measures to preserve this useful species are practiced on the large sugar haciendas. In newly planted cane fields this parasite is not highly effective, but as the age of the planting increases the population of this near-microscopic parasite builds up to a point where it becomes fairly effective, though it is never a complete control. When sugarcane is to be cut, it is first "fired" or burned, in order to get rid of the extremely thick leaves. But since this practice, as well as a too-thorough clean up of old fields, has been shown to destroy the weak-flying parasites, certain sections of the field are left untouched. In these unmolested spots the parasite continues to breed.

Another important pest of sugarcane is the "gorgojito negro" or black cane weevil *(Anacentrinus saccharidis),* a small beetle which tunnels in the stalk of the plant. Control measures are not highly successful against this species. On young cane plants the fall armyworm *(Laphygma frugiperda)* or "gusano picadura" causes serious feeding injury but it is seldom an important factor in mature fields. This species is destructive to corn, flak, and small grains also.

Along the coast and in the Amazonian lowlands the corn leaf aphid *(Aphis maidis),* known as "pulgon del mosaico," is abundant. It gets its name from the fact that it transmits the mosaic disease of sugarcane. Several species of weevils are moderately destructive to the roots of the cane plant, especially along the coast from the valley of the Río Rimac northward to Paramonga, where one of the largest sugar plantings in Peru occurs. "Gusanos cortadores" or cutworms, "gusanos blancos" or white grubs, and "gusanos alambres" or wire worms also attack the roots and crown of both the sugarcane and the cotton plant. These insects are generally serious along the coast, feeding also on tobacco, and garden vegetables.

Pests of Stored Products

One of the more serious problems in Peru is the damage inflicted by the various insect pests of stored grains, beans, seeds, dried fruits, and cereal products. As elsewhere in the world, much of this damage represents a hidden tax, much of which goes unnoticed until the destruction has passed beyond the stage of control. Most of the larger storage facilities are in the coastal section near the seaports

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Irrigation in coastal Peru has changed arid desert into fertile oases.

Attacking Brazil's Food Problems

A Brasileiro-Americana food-producing Commission, known as CBA, was formed in 1942 to aid the Ministry of Agriculture in meeting war-emergency food problems and in improving agricultural education. This article tells how those food problems have been partially solved.

by KENNETH J. KADOW

The advent of the war created serious food-supply problems in Brazil. Normally, the well-developed agricultural South supplied great quantities of foodstuffs to the Northeast and Amazon regions. Because the war, with its attendant submarine activity, imposed increased traffic upon the transportation facilities within the country, almost the entire supply of food from the South was cut off. Likewise, even in those sections of the Northeast which normally produced exportable surpluses the lack of transportation made practically impossible the moving of foodstuffs any distance. Substantial numbers of the poulation shifted into the Amazon Valley for the purpose of increasing rubber production, and Brazilian and United States Armed Forces were stationed in Northeastern Brazil in fairly large numbers. This rapid increase in population made great demands on an already deficient food supply.

Seed stored in warehouse, to be distributed throughout the Northeast section of Brazil.

In addition to these problems, created entirely by the war, the northeastern part of Brazil had just experienced one of the worst droughts in Brazil's recent history. The States of Rio Grande do Norte, Ceará, and Piauí, and parts of others had produced very little food during the 5-year period prior to the establishment of the *Comissão* in 1942.

The accumulation of these problems presented a real challenge to the Brazilian Ministry of Agriculture. The *Comissão Brasileiro-Americana de Producão de Gêneros Alimentícios* was formed by the Office of the Coordinator of Inter-American Affairs, representing the Brazilian and U. S. Governments, and has been functioning with 800 trained agricultural personnel under the direction of two commissioners—one Brazilian and the other North American—as an integral part of the Brazilian Ministry of Agriculture. Aided by a break in the long drought, the challenge to raise more food has greatly increased production in the Northeast; in fact, surpluses of stable foodstuffs have occurred in several localities, the outstanding being Maranhão and Alagoas. Some progress has been made also in the Amazon Valley, though the problem there is still a long way from being satisfactorily solved.

Seeds and Equipment Distributed

Through the facilities of the Brazilian Ministry of Agriculture, Extension Service seeds of corn, beans, and rice were distributed for the 1943 production season in increased

Typical Victory Garden developed in cooperation with a school for boys.

Thirty-one farms of this type are operated under the CBA Program.

quantities sufficient to plant over 500,000 acres. Because of localized drought and other uncontrollable factors, nearly 187,000 acres were lost, resulting in a net production of 313,000 acres. The majority of this was confined to the northeastern States, although some 35,000 or 40,000 acres were produced in the Amazon Valley. Similar results were achieved in 1944 with a small expenditure of funds, since farmers who received the initial distribution of seeds returned, for the most part, twice the original quantity at harvest time for redistribution.

In order to increase the quality as well as the quantity of crops produced and to reduce the necessity of purchasing large quantities of high-quality seeds from other regions in subsequent years, one or more large farms are being operated in each State under the direction of competent *agrónomos*. Several additional farms have been put into operation, with improved seeds, tools, tractors, and other equipment furnished either on a rental basis or at cost to private farmers who have the resources and abilities for producing quality seed on a commercial scale.

Of the small tools and equipment traditional to the local pattern of agriculture, some 103,480 hoes, 11,200 axes, and 20,000 *machados* (long knives) were distributed to relieve shortages which had occurred because of the lack of shipping and manufacturing facilities. More than 730 animal-drawn plows were loaned for use by farmer cooperators under the supervision of trained technicians, and 10 rice mills and other heavy equipment were made available. In recognition of the fact that the increase in production would automatically create a problem for seed storage for another year's crop, several hundred metal storage units were purchased and erected in key production centers throughout the northern part of the country. Likewise, to combat the major insect enemy, the sauva ant, some 1,300 hand-operated ant exterminators and 173 tons of arsenic and sulfur were provided.

Cash Loans to Farmers Through Cooperatives

During the first year $281,000 of CBA funds were made available for cash loans to small farmers. For the most part, this money was used by farmers to pay labor costs for additional farming operations. Most of the loans already have been repaid. Although loans to individual farmers rarely exceeded $250, these sums were responsible for several acres on each farm. In nearly all cases loans were made through farmer cooperatives or other farm organizations and were guaranteed by the government of the State in which they were made.

Technical Assistance Provided

One of the most effective methods of increasing food production was through direct technical assistance by a staff of Brazilian and North American Technicians to large private producers. Whenever a farmer was interested in increasing his acreage substantially and at the same time improving his methods and varieties of crops, full cooperation was given him. Plans were drawn up, new varieties introduced, heavy equipment, such as tractors, plows, cultivators, or other animal-drawn equipment, was rented to him on an operation-cost basis, and *agrónomos* were sent to supervise the work. This type of cooperation served the dual purpose of getting emergency production in those crops most difficult to increase, such as vegetables, and of teaching new methods to those farmers with funds, training, and initiative to continue on their own after they were well started. This was the method used for the production of high-quality seeds of such staple crops as rice, corn, and beans. In this program slightly over 100,000 acres resulted, several thousands of which were in vegetables.

Navy and CBA officials examine Light Sussex chickens on a poultry farm in the Northeast.

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Victory Garden Program

An intensive Victory Garden Program was undertaken for the entire country with the cooperation of several other government agencies, especially the *Legiao Brasileira de Assistencia* (LBA). In 1943 over 360,000 envelopes of seed collections were distributed and thousands of vegetable seedlings, such as tomatoes, peppers, and cabbage, and more than 1,000,000 fruit seedlings of papaya, banana, and others were given out. There were over 450 school gardens, which served the double purpose of supplying vegetables and teaching young people the rudiments of gardening. Courses were organized to train monitors in backyard gardening, and a total of 2,500 young men and women attended. These numbers do not take into consideration the large increase in production of fruit and vegetables by private agencies, which were stimulated by the Victory Garden Program. Likewise, the number of gardens which resulted during the second year of the program cannot be stated with any degree of accuracy at the present time, since the CBA took no active part in the national campaign during the 1944 season.

Meat and Poultry Farms

Nine pork-producing and forty-one poultry farms have been established to aid in producing meat and eggs for the Armed Forces. Their chief importance, however, lies in the opportunities provided for using them as model farms and in promoting private expansion throughout the area.

In spite of achievements already accomplished, many important problems of food production and supply still exist in Brazil. But the Ministry of Agriculture, with other resources and agencies, is doing much to meet these problems.

CROP PESTS OF COASTAL PERU

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and centers of consumption, chief of which is the mouth of the Río Rimac Valley, in which Lima, the seaport city Callao, and many smaller suburban cities cluster. Climatic conditions in these lowland areas are favorable to all types of pests attacking stored grain and seed, breeding taking place throughout the year. There is, moreover, heavy loss in the mountains as well, especially on the smaller farms.

These pests of stored and processed foods, seeds, and hides and furs are much the same throughout the world; they are as cosmopolitan as the housefly or the cockroach. To students of economic entomology in all parts of the world they are known as the rice weevil, bean weevil, Mediterranean flour moth, and a dozen others. A few are not generally encountered in North America, such as the false pink bollworm *(Pyroderces rileyi)* or "falso gusano rosado," which attacks both corn and wheat, and one grain borer, *Pagiocerus frontalis*. *P. frontalis* is particularly severe in the *Sierra* and on the eastern slopes leading down into the Amazon lowlands.

Some of the shipping interests maintain tight storage facilities in seaports where fumigation is practiced regularly. The Government is encouraging the development of modern storage methods, and in several production centers buildings where beans and similar products are stored have been equipped with modern *camaras* or chambers for fumigation. One firm in Lima, when confronted with the necessity of holding beans for a longer time than is usually considered safe, made two buildings airtight for fumigation by pasting layers of newspapers on the walls and ceilings and installing tight doors. These structures were perfectly adequate for carbon-disulphide fumigation. Carbon disulphide has been the principal fumigant in Peru despite its high inflammability hazard. During the past year a large importer in Lima has publicized the use of methyl bromide and is converting many warehouse operators to its advantages. The danger to operators and others through careless handling of this fumigant should not be overlooked.

Storage losses will continue to be heavy in Peru until tight storage is more general than at present, for conditions in the coastal regions favor these pests. One of the chief difficulties at present is that there is no way of preventing immediate reinfestation, since the grain must be removed to relatively open storage rooms as soon as it has been fumigated in order to make room for other infested produce. Production has increased at a much faster rate than it has been possible to provide storage facilities.

Pests of Fruits

Many other insect problems might be mentioned. Most of the acute pests of tropical and subtropical fruits are familiar to entomologists in Florida and California, particularly various scale insects and mealybugs, known in Peru as "queresas," many of which are world-wide in their distribution. Particular mention should be made of the fruitflies or "moscas de las frutas" *(Anastrepha* 4 spp.), which attack all citrus fruits, peach, guava, cherimoya, almond, mango, quince, níspero, plum, cherry, granada, fig, apple, and avocado. These pests are found in upland fruit-producing lands, but their greatest effect is felt in some of the coastal areas, especially in the Rimac Valley. The grape phylloxera (*Phylloxera vitifoliae*) appears to be on the increase as the growing of wine grapes increases. Many of these insects causing severe injury to fruits in Peru have found their way into the country through the channels of world trade.

The importance of maintaining viligance against domestic as well as foreign pests can be appreciated only with the realization that many insects of slight importance in their native homes become pests of great magnitude when transported to localities where the environment is more favorable to their development. More than half of the most serious agricultural pests of the United States have been imported from other continents. The same is true in Peru.

ALONG THE *Agricultural Front*

▲ Brazil's Fishing Industry Flourishing

In April 1943 the Brazilian fishing industry came under control of the Federal Government. An executive commission, called the *Comissão Executiva da Pesca,* was established, with central offices in Rio de Janeiro and a regional office in each State. The purpose of the Commission was to increase production of fish at a time when more meat was badly needed and to stabilize the price. Much has been accomplished along these lines.

Under the old system of distribution, agents purchased catches from fishermen and sold the fish at one central market by auction. Buyers from individual fish markets were obliged to appear at the daily auction in order to obtain fish. Fishermen had no guarantee that their catches would be sold, and the prices fluctuated according to supply and demand.

Now the Commission purchases the catches, and deliveries are made directly to the retail stores. In order to secure proper refrigeration, cleaning, storage, and retail outlet facilities, contracts have been made with private interests. The Mepesca Company, for instance, has a chain of 25 fish stores in the city of São Paulo and 3 more under construction.

Under the new system, production has been greatly increased. During the first half of 1944 it was more than 16 percent greater than during the second half of 1943. The size of the fishing fleet operating out of São Paulo is about 120 boats with a capacity of 12 to 14 long tons each, nearly double the size of the fleet operating before April 1943. These boats are partly owned by a government-controlled fishing company, the *Empresa Nacional da Pesca.* Rio de Janeiro has an even larger fleet. The *Secretaria da Agricultura* estimates that fish consumption in the State of São Paulo has increased from 295 to 730 long tons per month, an important fact in view of the shortage of beef and pork.

Prices also have been improved. Fishermen are assured security of sales and are receiving 4 times the former amount for their fish. At the same time a lower selling price has been fixed for the consumer.

▲ New Insecticide Plant Established in Lima

A factory for the production of insecticides was recently established in the Molina Moran, Plaza Acho, Lima. The plant is known as the Insecticida Babbini, S.A., and is equipped with two Papeo Mills, two stone mills, one mixer for dry insecticides and three electric motors, all originally from the United States. The factory is producing in excess of 1,000,000 pounds of insecticides yearly, and expects to increase that production to 4,000,000 pounds a year in the near future. This should approximate Peru's requirements.

Babbini is the name of the insecticide now being produced by the factory. This insecticide is intended for use against pests that attack the cotton plant. It is composed of chili pepper (*ají*), Indian caustic barley (*cebadilla*), arsenic (*arsenico*), and quick lime (*cal viva*). The pepper, quicklime, and arsenic are produced in Peru, while Indian caustic barley comes from the United States, Mexico, or Venezuela. The new insecticide is believed to kill not only the worms but also the aphid that attacks the cotton plant.

▲ Cotton Textile Factory Proposed for Panama

The organization of a cotton textile company and the proposed erection of a cotton textile factory in Santiago, Panama, have been announced. Production at first will be confined to unbleached cotton cloth and printed cottons. During the first years the required cotton will be imported, but a cotton-producing zone in Panama is proposed, to supply locally the needs of the mill. Cotton-textile machinery will be purchased from abroad.

▲ U. S. Chemists Perfect Non-irritating Fly Spray

Chemists in the Agricultural Research Administration, U. S. Department of Agriculture, have perfected a non-irritating household fly spray.

The spray is the result of a new method of purifying pyrethrum so that it will be less likely to produce irritating rashes or hay fever, which have limited its use for certain purposes in the past. With this discovery scientists at the Beltsville Research Center, Beltsville, Maryland, say pyrethrum sprays, non-toxic to man but deadly to flies, mosquitoes, and other household pests, can now be used without discomfort in the home or any place where people congregate. The spray, developed by three chemists in the Bureau of Entomology and Plant Quarantine, is practically stainless, is more concentrated for shipping, and is less likely to clog spray-gun nozzles.

This spray is used in the new automatic spraying device called the aerosol bomb, a Department of Agriculture wartime invention provided to the Armed Forces for wartime control of mosquitoes. Entomologists say this aerosol promises to be an effective postwar weapon against flies in homes, restaurants, airplanes, and public places, and to kill other pests such as cockroaches, bedbugs, ants, mosquitoes, house spiders, silverfish, chiggers, carpet beetle larvae, ticks, and fleas.

The aerosol sprayer is a small handy can dispenser that holds a liquified gas such as Freon, which is now used in household refrigerators. When a valve is opened the dispenser emits a foglike spray that is much more effective than the ordinary coarse sprays. While not yet available for civilian use, more than 13 million of the Freon-aerosol "bombs" have been supplied to the Armed Forces.

▲ Concepción, Chile, To Have Veterinary Hospital

The Southern Agricultural Society and the Milk Cooperative of Concepción, Chile, have undertaken to establish a veterinary hospital or institute in that city. A portion of the extensive exposition grounds of the Society are expected to be adapted for service as an isolation ward for sick animals. The necessary veterinary instruments and medicines are being purchased.

NORTHEASTERN DRAINAGE AREA

(Continued from back cover)

Brazil. The basins of the Apodi and the Assú, the largest streams in the State of Rio Grande do Norte, resemble those of Ceará in type of product and also account for most of the northeastern area's small gypsum production.

Eastern Agricultural Section

East of the drought region is a strip along the coast characterized by permanent agriculture, where rain falls more abundantly from the clouds coming in from the sea. Some dense semi-deciduous forests in the center of this strip help to retain moisture. A sugarcane belt extends down its coastal side, producing between a third and a half of Brazil's sugar, and cotton and coconuts grow here also. On the strategic bulge of this coast lie Natal and Recife, old seaports newly bustling with the activity of the United Nations' ocean and air supply routes, through the cooperation of our ally Brazil.

This crop region is sharply distinguished from the alternately drab and green scrub pastures of the interior by a line of demarcation called the *travessão*. There is a legal basis for this line—croplands must be fenced to the east of it, but pastures stretch open on the west, where livestock range.

The streams flowing to the east coast are not important commercially. The Capibaribe flows through Recife but is little traveled beyond the city limits, and the chief transportation service of the Paraiba is to connect Paraiba's State capital, João Pessoa, by water with its port of Cabedelo.

Northwest Tropical Basins

Northwest of the Parnaiba River is a large region where heavy rainfall produces a damp tropical climate. Here the rivers, in contrast to the intermittent streams of the drought region, flow during the entire season, though the quantity of water still fluctuates. Much of the sparse population of this large northwestern region is concentrated in the basins of two rivers, the Parnaiba and the Itapecurú.

These two basins, tangent in the interior but forming the two sides of a triangle as they approach the coast, comprise the prime babassú-producing and -exporting region of the world. The Parnaiba is by far the largest river of the entire drainage area as well as the most permanent and important, including in its basin practically all of the State of Piauí and some of Maranhão. Human settlement along it concentrates in the lower basin between the up-river port of Teresina and the mouth. Small steamers navigate the river for 400 miles of its lower course, and smaller craft go farther inland toward the source in the Serra da Tabatinga Range near the Goiaz border some 600 miles from the mouth. Much merchandise floats on rafts from the far upper river and its tributaries to cities as far downstream as Teresina, where it is sold locally or trans-shipped by boat. One tributary is named Rio das Balsas, after these rafts called balsas, and most of its traffic is raft-borne. The Itapecurú is navigable for launches as far up as Caxias, Maranhão's second-sized city. Paralleling the Itapecurú in its course below Caxias, and extending beyond to Teresina is the São Luiz-Teresina Railroad. Much babassú goes down the valley to São Luiz for export.

Other rivers in this northwest region are the Mearim and the Grajaú. The former is over 400 miles long and is navigable the year around for small launches as far as Barra do Corda, in the center of the State of Maranhão. On the other hand, the shorter Grajaú, which joins the Mearim before its waters reach the port of São Luiz, dwindles so much during the dry season that merchandise in transit piles up on the banks to await the rains.

In addition to babassú, these basins produce cotton and other fibers, sugarcane, hides and skins, rice and grains, mandioca, fruits, and various other food crops and vegetable oils. Cotton textile and sugar mills, gins, processing of foods, and curing of hides are among local industries, besides those based on crushing babassú and other vegetable oils. A little gypsum has been mined in the Grajaú basin.

The People

The people of this northeastern part of Brazil are of predominantly Portuguese descent, though there is much Negro blood along the coast. The Indian strain increases west from the Parnaiba Basin. The large cities follow the coast. Recife has a population of about 500,000, Fortaleza, 200,000, and João Pessoa, Maceió, São Luiz, and Natal each under 100,000.

The Future of the Area

The future of the northeastern drainage area, like that of potentially powerful Brazil as a whole, depends on development of the resources of the area and on world needs for the products of the region. In the drought region, practical irrigation systems in localities where droughts are mild, scientific reforestation, and resettlement of populations now in "calamity" regions can improve conditions. The continued development of the vegetable oil, wax, and other forest resources in which both the drought and the northwestern sections abound will depend on world demand, competition, quality standards achieved, and the extent of domestic utilization.

INDIAN GARDENING

(Continued from page 49)

Combined with the coconuts, bananas, and other fruits from roadside trees or those about his thatched house, such food is quite sustaining. This is varied by spicy soups and stews containing, when possible, bits of meat and prepared in a fashion similar to the well-known "boiled dinner."

The vegetables found most commonly in his garden are the arrowroot, beans, beets, calabazas, manioc, radishes, and squash. There are also small native potatoes, miniature tomatoes, little chili peppers, sweetpotatoes, onions, carrots, cabbages, cucumbers, chickpeas, lettuce, and pumpkins. Many of these are grown with their roots under the trash blankets, others are transplanted onto raised-ground beds or are sown in the open field. Some are grown during most of the wet season to mature in the dry season; others are grown the year round, depending on mountain dews or irrigation for moisture during the dry season.

To make a complete study of the indigenous gardening methods of the El Salvadoran Indian would require years, for each garden must be suited to its own conditions and needs. Although the Indian uses the fruits of his garden for trade and barter and, in a small way, for sale in the markets, his plots are most important as a means of subsistence.

A History of Latin America for Schools, by Samuel Guy Inman and C. E. Castaneda. 442 pp. The Macmillan Company, New York; 1944. As its title implies, this is a volume designed for use in schools, but it has much of interest to all who desire a deeper understanding of the other American republics and our relations with them. It covers the field under four headings: First, the people and the land; second, their historical backgrounds; third, cultural and trade relations of the Latin American republics among themselves, with the United States, and with the rest of the world; and fourth, art, literature, and music, from earliest times to the present. The appendix contains data on where to obtain maps, motion pictures, music, recipes, reading lists, and other useful study aids.

A Century of Latin American Thought, by William Rex Crawford. 311 pp. Harvard University Press, Cambridge, Massachusetts; 1944. Taking the stand that in order to understand the "heart and soul of a culture" one must know the men whom it calls great, the author presents the *pensadores,* or great thinkers, of Latin America during the past century.

Colombian Cinchona Manual, by F. R. Fosberg. 33 pp., illus. (Processed). Foreign Economic Administration, Bogotá, Colombia, S. A.; 1944. This is a second edition of the *Manual* presenting in simple language an outline of what is known of the scientific aspects of cinchona in Colombia up to June 1944.

The Pan American Way of Life and Outline of Crowson Topical Spanish System, by Ben F. Crowson, Jr., 111 pp. (mimeographed). Pan American Educational Center, Washington, D. C.; 1944. This is a collection of divers writings of the author, reviewing inter-American relations, both economic and educational. Unusual features are: A series of short sketches on people active in Pan Americanism; a Pan American quiz; and an exposition of the author's topical method for learning the Spanish language.

Editor's Note.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

COSTA RICA—LAND OF FORESTS

(Continued from page 46)

of the growing interest in palms as a source of valuable oils, waxes, fibers, and other commercial products, a survey of this unused resource is desirable.

Emphasis cannot be placed too strongly on the fact that Costa Rica's forest land is still very largely *terra incognita.* It is to be hoped that these forests will be handled without exploitation and that through research, surveys, the introduction of professional forestry practices, and the promotion of a conservation-minded populace, they will be both developed and maintained as a great and permanent resource for the people of Costa Rica.

Graceful coconut palms dominate the foreground of this peaceful beach scene at Punto Dominical, Puntarenas Province. Mangroves are seen in the background.

AGRICULTURE IN THE AMERICAS **O. R. CARRINGTON, EDITOR**

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Gifts of the Americas

ALLSPICE

by **EDWARD L. TANNER**

Allspice, pungent and aromatic, is All-American. It is one of three spices which the conquest of the Americas gave to the world, and one whose commercial production is, up to the present, limited to the Americas.

For centuries before the discovery of the New World, Europe had been receiving a trickle of spices from the vague and fabulous East. Spurred by the desire to find the place where these spices grew, the bold adventurers of western Europe turned to the uncharted ocean and found at last the route to the East. The rich cargoes of pepper, cloves, nutmeg, and cinnamon which they brought back meant great wealth.

Allspice, however, did not share this romantic mystery and adventure. Being a native of America, it found itself in competition, not with the spices of the East as a source of wealth, but with the gold of the Aztecs and of the Incas. Until the Spanish conquerors had depleted the available gold supplies of their newly conquered lands, the spice berries growing wild along the Caribbean attracted little attention. One writer states that this new spice was first introduced into Europe shortly after the beginning of the seventeenth century as a substitute for cardamon, the aromatic fruit of an East Indian herb. Nearly a century later it was distinguished as a Jamaica spice under the name of "sweet-scented Jamaica pepper or allspice." The common name "allspice" originated from the resemblance of its flavor and fragrance to a combination of spices, with nutmeg, cinnamon, and cloves predominating.

The tree which produces allspice is known botanically as *Pimenta officinalis,* belonging to the myrtle family and to the same genus as the clove tree. Two species of shrubs in the southern part of the United States are sometimes referred to locally as allspice, and there is another in Japan which is often called by that name. Probably others of the American nations have local plants which are called allspice and which are locally used, but the true allspice of commerce comes only from the berry of *Pimenta officinalis.*

The allspice tree is a beautiful evergreen tree, well shaped, and growing to a height of 30 feet, with occasional specimens up to 40 feet. The fruit, borne in terminal clusters, is a round berry about .3 inch in diameter. The berries are harvested when the color is still green. They cure with a rough surface and a dark brown color, which always characterize the best grades.

The allspice tree is native to the Caribbean Islands and to some parts of the adjoining mainland of southern Mexico, Central America, and northern South America. It is found on soils of a calcareous nature and is cultivated from low elevations up to altitudes of 4,000 feet.

The commercial product enters trade from Jamaica, Mexico, and Guatemala. The 5-year averages of 1937-1941 shipments from the three countries were: Jamaica, more than 5,000,000 pounds, Mexico about 500,000 pounds; and Guatemala 25,000 pounds. Of the world's production, the Western Hemisphere uses slightly more than 40 percent and most of the remainder goes to Europe.

In Jamaica an allspice planting is called a "walk." In the establishment of "walks" man has resorted to one of his frequent stratagems by which the necessary degree of dominance is established over tropical vegetation. The proper site having been selected, the few natural-growing allspice trees on the land are left standing while other vegetation is slashed and permitted to rot in place. Within a short time after the destruction of competing vegetation young allspice trees come up thickly over the whole area and, taking advantage of the temporary ecological imbalance, they make fast growth. At the end of 2 years the planter again steps in and cleans the area. A good stand of allspice is left while all other growth is removed. The young 2-year-olds are then able to take care of themselves with a minimum of aid from the planter. After about 5 more years the "walk" comes into bearing, and a mature tree produces approximately 100 pounds of dried spice annually for many years.

In addition to producing one of the world's best spices, the allspice tree also gives us wonderful material for walking sticks and for umbrella handles. The young trees, when grown to the right size, are highly prized for this purpose and are so used by the thousands.

Attempts were made at an early date to introduce *Pimenta officinalis* into the economy of the East Indies and other spice-producing areas, but without success. A hundred years ago there were splendid specimens of the tree in the Botanic Gardens of Singapore and Ceylon which bloomed profusely but set no fruit. Today allspice still remains All-American.

NORTHEASTERN DRAINAGE AREA OF BRAZIL

by **Allen H. Lester**

In comparison with the river basin of the mighty Amazon and with the vast expanse of Brazil, the northeastern drainage area is surprisingly small, although larger than the States of Oklahoma and Texas combined. It differs from most other Brazilian drainage areas in that it does not consist of the basin of one large river into which flow various tributaries. Instead, there are many rivers, all comparatively short, and all flowing independently in a northern or eastern direction to the Atlantic. The area is located in that part of Brazil east of the mouth of the Amazon, extending around the point of the shoulder, to a point a short distance below Maceió.

The Drought Region

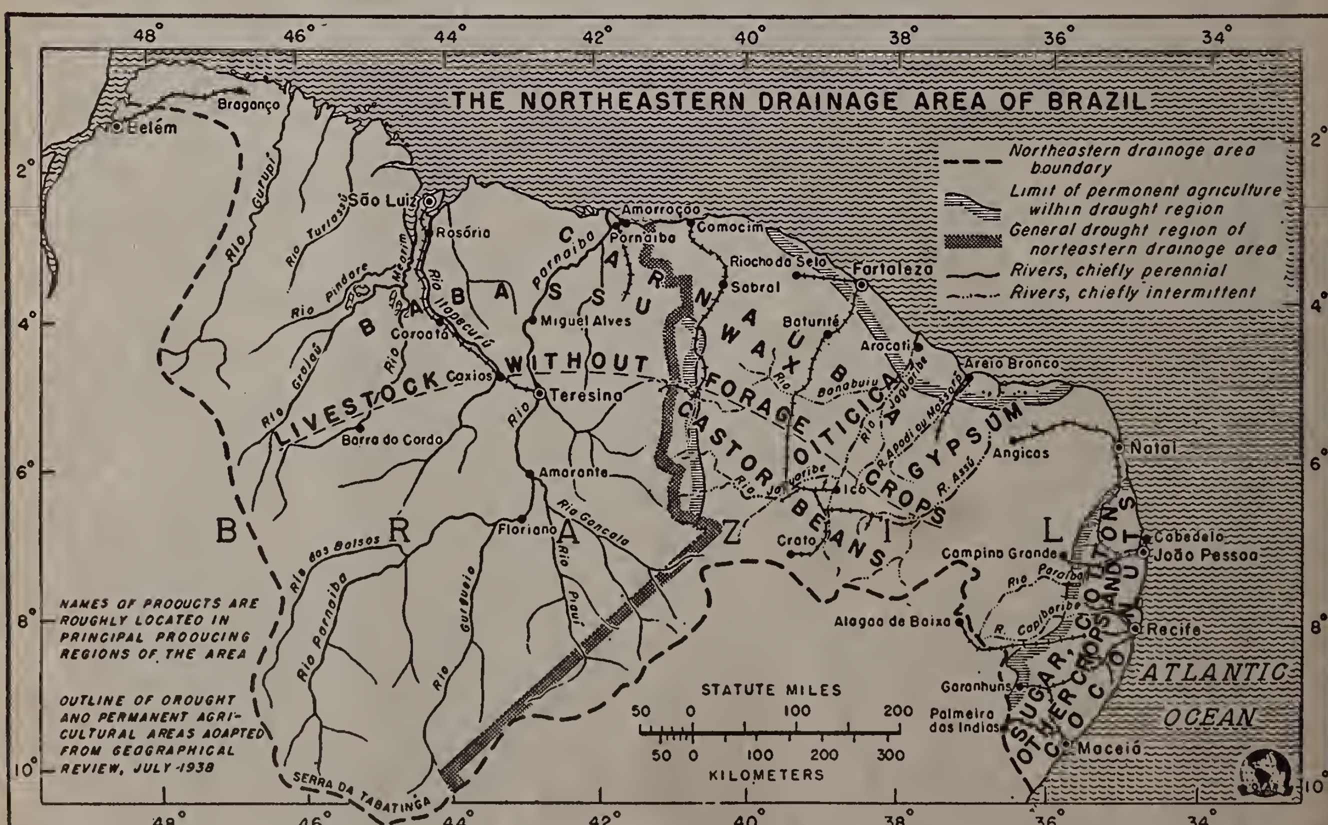
The whole area is, perhaps, best known through the periodic droughts which scorch the lands of the central and southeast inland section. Stories of the emigrations of farmers from drought-stricken Ceará to the Amazon rubber region during the nineteenth century have figured in history and fiction. Even during the present war a severe drought has given opportunity to encourage another flow of emigration to the rubber lands.

Although broken by a few oases, the drought region generally permits no permanent cropping. Not only the scarcity of rainfall but the uneven distribution of it creates a major problem in this area. Rain which might be sufficient if evenly spaced often falls with such great concentration that floods come immediately, droughts later. To relieve this situation the Brazilian Government is building a system of storage dams.

Wax- and Oilseed-Producing Basins

The rivers reaching the Atlantic on Brazil's northern coast, in the States of Piauí, Ceará, and Rio Grande do Norte, have their sources in the drought region. They are, therefore, intermittent and not suitable for commercial navigation. The basins do, nevertheless, provide four of the chief export products of the northeastern drainage area—carnauba wax, oiticica oil, castor beans, and cotton—and make the area the sole significant world producer of the first two. Carnauba wax, valuable for floor polishes and many other uses and prized generally because of its high melting point, is produced chiefly in Piauí and Ceará and adds more to the value of Brazil's exports than any other palm or oilseed product. Though the carnauba palm grows outside the drought area also, the coating of wax which the tree produces to prevent the loss of precious moisture in the sun's hot rays is heavier in this semi-arid region than elsewhere. Oiticica seed, the source of oil needed for quick-drying paints and varnishes, is produced in largest quantities in Ceará's Jaguaribe River Basin, with the Acaraú a secondary producing area. Ceará's basins are also the important northeastern producers of the castor bean, another oilseed, which grows, however, elsewhere in and outside of

(Continued on page 57)



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NAMES & NEWS

Venezuelan Agronomists To Study in United States

Señores Gustavo Padilla, Pedro Castillo, and *Antonio Martínez,* Venezuelan agronomists, are in the United States taking courses in dairying and agriculture, on the invitation of the U. S. Government.

Receives Fellowship

Senhor José Maria Joffily, Brazilian Plant Pathologist, has received a fellowship from the University of Michigan for special studies in his field. The fellowship was arranged for through the Institute of International Education.

To Make Rural Social Studies in Ecuador

Olen E. Leonard, Rural Sociologist for the Office of Foreign Agricultural Relations, who has been conducting a survey in rural social organization to aid in establishing Extension Programs in Nicaragua and Guatemala, is now conducting a similar survey in Ecuador for the Cooperative Agricultural Experiment Station. This Program is expected to help increase the production of strategic and complementary crops in Ecuador.

To Visit Mexico

Clay G. Huff, Professor of Parasitology at the University of Chicago, has accepted an invitation from the Institute of Public Health and Tropical Diseases of Mexico City to visit that institution as guest investigator. The trip will be made under the auspices of the U. S. Department of State.

Dr. Huff's research has been largely in the field of malaria with special investigation of mosquito transmissions and life cycles. He has devoted considerable attention recently to malaria in lizards and the development of malarial sporozoites in the vertebrate host.

Returns to Mexico

Thomas D. Mallory, of the U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering, recently returned to Mexico to continue work on the development of experimental and demonstration rubber plantations.

Returns to Ecuador

Lee Hines, Director of the Cooperative Agricultural Experiment Station at Quito, has returned to Ecuador after spending several months in this country in conferences with Department of Agriculture officials on problems relative to the production of rubber and to drug, oil, and insecticidal plants.

Will Inspect Mexican Chickpea Crop

Joseph E. Elstner, of the War Food Administration, left recently for Mexico, where he will assist with the inspection and grading of the 1945 crop of chickpeas *(garbanzos),* which has been purchased by the U. S. Commercial Company and assigned to the Commodity Credit Corporation.

Two Chileans Awarded Rockefeller Fellowships

Señores Hernan Gacitua Lowick-Russel and *Dionisio Pavez Saa,* of the Chilean Ministry of Agriculture, have been awarded fellowships by the Rockefeller Foundation to pursue advanced studies in the United States in methods of crop cultivation and improvement.

To Study Citrus-Pest Control in Latin America

Walter Ebeling, Associate Entomologist for the Citrus Experiment Station at Riverside, California, will leave shortly for a 2-month field trip to Peru, Chile, and Colombia under the sponsorship of the U. S. Department of State. Mr. Ebeling will study methods of control for various citrus pests and will inspect the work being carried on at the Palmira Experiment Station in Colombia.

Agriculture IN THE Americas

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Bananas in Wartime

The scarcity of bananas during the war years has made us appreciate more than ever this favorite fruit. Here is the story of the industry and of some reasons for the shortage.

by GUSTAVE BURMEISTER

One of the sharp impacts of this war, on the Americas, has been reduction of the banana trade between the important Central and South American producing areas and the United States and Europe. Exports to Europe were almost completely cut off in the early part of the war period and were curtailed substantially to the United States in 1942.

In peacetime, few consumers in the United States realized the magnitude of the human effort, capital, and equipment required to maintain a steady flow of bananas in the channels of distribution. This luscious fruit could be purchased every day at the retail stores and on fruit stands in every city, town, or village with little thought or effort on the part of the consumers, and prices were seldom anything but reasonable. With the coming of the war to America's shores in the form of the German submarine the flow of bananas was greatly reduced, because ships are an important link in the distribution chain. The flow was cut in the middle, and this had the double effect of causing economic depression in the producing areas and almost consumer starvation for the fruit in the United States.

The Banana Trade

The principal exporting areas of the Americas may be divided geographically into four groups: Mexico, the West Indies, Central America, and northern South America. For the first 3 groups 1937 was a banner year for recent times, while for northern South America 1938 was the big year. In 1937, exports from Mexico totaled close to 9 million bunches; from the West Indies, 35 million; and from Central America, 47 million. In 1938, exports from northern South America totaled 20 million bunches. These were record high shipments except for Central America, which reached a peak in the late 1920's. Because of the ravages of the sigatoka disease, exports from this group have declined sharply in recent years.

Jamaica, with nearly 22 million bunches exported in 1937, was by far the leader in the West Indies group, followed by Cuba with 7.5 million. In Central America, Honduras with 19 million bunches was the outstanding exporter, but Guatemala, the Republic of Panama, and Costa Rica were also important with around 8 million bunches each. In 1938, Colombia led the northern South American group with exports totaling more than 8 million bunches, followed by Brazil with over 6 million.

Production and exports declined slightly during the next 2 years as the disease spread, and then the war in Europe forced a sharp decline in exports from the West Indies, Mexico, and northern South America. Exports from Central America held to a relatively high level until the war came to the Americas in 1942, when they were cut in half. By 1943 exports from Mexico had dropped to a little over 4 million bunches, from the West Indies to 3 million, from Central America to a million and a half, and from northern South America to 2.5 million bunches. Some recovery, however, is indicated for 1944.

The United States was the principal market for the relatively small exports in 1943 since it was practically impossible for other consuming areas to obtain shipping. Mexican exports were largely transported by rail, while the exports from the other areas were chiefly back-hauled

The author is head of the Division of Fruits, Vegetables, Sugar, and Seeds of the Office of Foreign Agricultural Relations.

Courtesy of United Fruit Company

Clipping the main stem of the tree about midway to the top permits the bunch of bananas to drop to the shoulder of the "backer."

cargo on ships which had carried strategic supplies from the United States to the various countries.

Even in peace the United States was the principal destination of bananas exported from Mexico, Central America, and the West Indies except Jamaica, which exported largely to the United Kingdom and Canada. The principal market for northern South American bananas was other Latin American republics, such as Chile and Argentina, and continental Europe, largely the Netherlands and Germany. The United States took about 60 percent of Western Hemisphere exports just prior to the outbreak of the war in Europe, but during the war period the proportion rose to about 95 percent despite the difficulties of shipping.

How Bananas Came to the Americas

This war's effect on the banana industry is only one of the many trials in the history of the fruit. Although it has been known to mankind and recognized as a tasty food-fruit for hundreds of years, it did not gain importance in world trade until the early part of the twentieth century. The origin of the fruit is not clearly determined but the belief is generally conceded that it is not native to the Americas. It was brought to Santo Domingo early in the sixteenth century by a Spanish missionary, the Reverend Father Tomas de Berlanga, from the Canary Islands. The banana is generally believed to have originated in the humid tropical areas of Southern Asia but was carried by the Arabs to the Middle East before 650 A.D. and from there across Africa to the Guinea Coast. Here the Portuguese traders found it in 1482 and transported it with its African name "banana" to the Canary Islands.

Father de Berlanga moved on to what is now known as Panama, taking with him the valuable food plant. The records show that wherever a Spanish Mission was located in the Tropics one of the first tasks was to plant bananas.

Although the fruit provided for many years an important element in the diet of the peoples of the Tropics, where it did not have to be transported any distance, few thought it would ever become an important international trade commodity because it is so highly perishable. Also, meticulous care and practices are required to bring the fruit into proper condition for eating. Even in the Tropics the fruit is not permitted to ripen on the tree because it would then become insipid and almost tasteless. It must be cut green and ripened under controlled conditions. Nature can produce the banana but man has to condition and ripen it. Man has learned to use tropical nature and to combine its efforts with his own to produce one of the most important commercial fruits.

Early in the nineteenth century a few stems of bananas were shipped from Cuba to New York and by 1850 the clipper ships were bringing occasional cargoes. In 1870 Captain Lorenzo D. Baker, of Cape Cod, brought bananas in good condition from Jamaica to Boston in 18 days. This attracted the attention of some Boston merchants, who developed the business. In 1885 these merchants organized an association to import bananas from the Tropics. This business was well organized with ample capital and good management by 1899. These early pioneers soon learned that, in order to maintain a steady flow of good sound tasty fruit, production, transportation, ripening, and distribution had to be geared together into continuous integrated organization. They found it necessary not only to produce bananas but to improve sanitation, provide food, housing, hospitals, schools, and transportation facilities for the inhabitants of the great plantations. Also a great deal of experimental work has been carried on dealing with every phase of the banana industry. This work has led to new discoveries concerning the fruit and its production and marketing problems.

Varieties

The banana plant belongs to the Musaceaa family, genus *Musa,* which includes many species. The most important fruiting species are: *Musa sapientum* (fruit of the wise

men), the yellow banana of commerce grown in the Caribbean countries and islands; *Musa cavendishii* (Cavendish or dwarf variety), grown in the Canary Islands, in Africa, Asia, and on the islands of the Pacific and Indian Oceans; and *Musa paradisiaca* (fruit of Paradise, because the legend is that it grew in the Garden of Eden), now commonly known as the plantain and found throughout humid tropical regions of both the Eastern and Western Hemispheres, where it is considered a staple starchy food. Plantains are cooked and eaten in tropical lands as potatoes are in the temperate zones.

From a commercial standpoint, the most important variety of the species *Musa sapientum* is the Gros Michel. This is the big yellow banana with which consumers in the United States are most familiar and which is produced so extensively in tropical America. There is another variety of this species, the claret or red banana, which is luscious eating but does not ship well because the individual fruit will not cling to the stem.

How They Grow

The banana plant, commonly called a tree, grows rapidly and contains a high proportion of water. It is distinguished as the largest of all plants which do not have a woody stem above ground. In fact the true stem is below the surface. The part above ground is a leaf sheath and is called the "false trunk." It has no tap root but does have an extensive lateral root system, which absorbs moisture and plant food from the soil just below the surface for as much as 15 feet or more. There are a few anchor roots that go down from 2 to 6 feet, depending on the type of soil. The deeper-rooted plants are found in the lighter sandy loams. On the underground stem large buds are found from which sprout the leaves in tightly rolled spears. Growth is rapid, with new leaves pushing up through the center of the "false stem." When fully grown the leaves are from 8 to 12 feet long and number 8 to 20 per plant. They spread out or rise almost vertically, making a palm-like effect.

The first leaves appear 3 to 4 weeks after the rhizome is planted, and in about 12 months the tree is 15 to 30 feet tall. In the tenth month the blossom encasing the fruit stem shoots out of the center of the crown of the stalk. It takes 3 to 4 months then to develop a bunch of bananas suitable for cutting.

Each plant bears but a single bunch, or stem, of bananas, which consists of a number of hands with varying numbers of fingers. The size of the bunch is determined largely by the soil and climatic conditions prevailing where the plant is grown. The usual commercial bunch has about 9 fully developed hands of approximately 16 fingers each, or 144 bananas per stem. Other sizes are marketed,

Courtesy of United Fruit Company

Banana plantations require an even distribution of water, which is supplied by an intricate system of canals.

Courtesy of United Fruit Company

A fully developed bunch of bananas growing in Honduras.

however, such as 6, 7, and 8 and sometimes 10 and 11 hands. The number of fingers per hand also varies in accordance with the number of hands. A 6-hand stem will have about 13 fingers per hand; a 7-hand stem, 14 fingers, an 8-hand stem, 15 fingers, on up to a 14-hand stem with 18 fingers.

Soil and climate play important roles in the commercial production of bananas. The best soils are the clay and fine sandy loams with good drainage and low water table. Soils should be deep. Drainage is important because the banana cannot live with wet feet, yet the plant requires a great deal of moisture and an abundance of nitrogen. The ideal climate is one devoid of extremes of temperature and with frequent light precipitation throughout the 12 months of the year. This climate is seldom found in the important banana-producing areas. Therefore, man has to improvise. Proper drainage can be engineered and rainfall can be supplemented with irrigation in some areas. High temperatures are not harmful to the banana if humidity is high, but the plant will be chilled if the thermometer drops to 50° F.

Banana Plantations

Because of the ravages of disease, wearing out of the soil, and other reasons, it is frequently necessary to abandon a banana plantation and move on to virgin land. After the site has been located and surveyed, the drainage ditches are dug and the underbrush is cleared away. The land is then lined and staked and made ready for planting. Stakes are set where it is intended to plant, from 15 to 18 feet apart each way. Rhizomes are usually selected from adjacent healthy plantations and cut into pieces weighing 3 to 4 pounds each and having at least one good eye or bud left on each piece. Frequent inspections are necessary to make sure that plantings are done properly. At each stake a hole about 1 foot deep is dug and a piece is planted with the bud toward the bottom.

After completion of the planting operations and before the sprouts appear above the ground, all of the big timber is cut down leaving a tangle of branches, logs, and stumps. Then through this jungle roads and railroad lines must be built. The tangled mass of timber soon rots away, making a good mulch and adding humus to the soil. It thus provides excellent growing conditions for the young banana trees. In about 3 months after planting, the plantation is ready for the first cleaning, which involves trimming off the branches of the felled trees and cutting weeds and other tropical plant growth. This procedure is repeated about every 3 months.

In the meantime roads are completed, railways are laid, housing for employees is prepared, and everything is made ready for the harvest. This is usually a race against time and requires huge outlays of capital and labor. Swift changes in weather conditions may interfere with this work so that the most promising outlook may be changed overnight by a hurricane or sudden flood.

The Harvest

In 12 to 15 months after planting, the fruit is ready for harvest. Cutting must be geared to shipping, however,

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Courtesy of United Fruit Company

Fruit is transported by pack mule to the railroad siding.

Little boys of Montecristi collect Panama hats from the residents of the town who have woven them under contract for the brokers and finishers.

Ecuador's Panama Hat Industry

One of the most interesting Latin American home handicrafts is the so-called "Panama hat" industry which is largely centered in Ecuador, providing that country with one of its most important and profitable industries.

by **BEATRICE DU FRANE**

Panama hats did not originate in Panama. The belief that they are woven under water is not true. Nor is the plant from which the hat fibers are usually procured a palm, although it is sometimes called the Panama hat palm. Hats made of actual palm fiber and dubbed Panama hats are usually heavier than the true Panama and the fibers are flat rather than cylindrical.

Francisco Delgado, an Ecuadoran, is reputed to have made the first Panama hat about 1630 in the Province of Manabi, Ecuador. But it was not until the middle of the nineteenth century, during the California Gold Rush, that the hats found their way into the United States. At that time Panama served as the commercial outlet for these soft, pliable, finely woven straw hats manufactured in Ecuador. Prospectors returning East by way of the Isthmus purchased the hats in Panama and introduced them into the United States as "Panama hats." Although the fact was widely known that the hats were produced in Ecuador and the Panamanians made no pretense of manufacturing them, the misnomer clung and is still used. Today the term is applied indiscriminately not only to straw hats manufactured in Ecuador, which continues to be the chief producer, but to hats made in Colombia, Panama, and other countries of Latin America.

Ideal for wear in warm climates and during the summer in temperate zones, Panama hats range in price from one dollar to several hundred. In Ecuador they are produced by the Indians or Mestizos. Most of the weavers are women or children, although some of the men have sufficient finger dexterity to succeed in the art. This handicraft industry, handed down from generation to generation, provides part-or full-time employment for a great many people. It is often practiced as a sideline to agriculture. Manufacture of the hats in factories has not proved successful in Ecuador.

Fiber Used in Hat Making

Fiber for Panama hats is obtained from several species of plants. The most frequently used is the *Carludovica palmata,* which was named botanically in honor of Charles IV and Queen Louisa of Spain. *Carludovica palmata* is commonly known in Ecuador as the *toquilla* palm, and its fiber as *toquilla* or *paja de toquilla. Jipijapa,* which means straw, is the name given to both the processed fiber and the hats in the town of Jipijapa, one of the most famous hat-making villages in Ecuador. The fiber or plant is known as *junco* in Honduras, *cogollo* in Venezuela, *raicilla* in Panama, and *iraca* or *palmichi* in Colombia.

The *toquilla* plant grows best in hot, humid areas, thriving especially well in the lowlands of western Ecuador and in the area of the upper Magdalena River in Colombia. It may be found from Guatemala and Honduras in Central America to Ecuador, Peru, and Colombia in South America. The plant also grows east of the Andes in Venezuela and in British Guiana, and has been introduced into Puerto Rico, the Philippine Islands, Java, and perhaps other tropical areas.

Ecuadoran hats are world-famous for their fine quality and attractive designs.

The *toquilla* palm is native to the tropics of the Western Hemisphere. It reaches a height of from 6 to 10 feet and resembles a trunkless fan palm. It has no true stem, the leaves growing from the ground on long, slender, triangular petioles which may attain a length of as much as 10 feet. Fan-shaped and parted into four or five divisions, each of which is further separated, the leaves may be more than a yard in diameter. They attain most of their growth while folded in the bud in plaits. The flowers grow at the base of the leafstalks in a spike.

While most of the hat straw is obtained from wild plants, efforts have been made to propagate the *Carludovica palmata* from suckers or seeds. The plant can be grown in large quantities on banana plantations. The banana plants offer shade and thereby conserve moisture, both of which are beneficial to the growth of the *toquilla* palm.

The straw that is used in making the hats is obtained from the leaves of the *toquilla* palm. These leaves are cut when young, either before they expand or just as they open. By cutting the leaves so that one-half to 1 inch of stalk remains, each leaf is provided with a handle, which is particularly useful in later operations when the leaves are dipped in boiling water. After the coarse outer filaments have been removed, the leaves are dipped a number of times in boiling water. A bleaching agent is often added to the hot water to give the straw a whiter appearance. Then the leaves are roughly shaken and hung up to dry, usually in the shade, although in some areas they may be bleached in the sun or exposed to the night air. Some of the moisture is retained. The leaves are kept clean by wrapping them in cloth and handling largely by the stems.

With the fingernails, or with a tool made of needle points set within a wooden handle, the plaits are split lengthwise. The resultant strips may be given further treatment in boiling water. Then they are thoroughly dried. Within a few days the fibers shrivel, becoming string-like. The straw is now ready for weaving.

Straw from the *mocorra* may be used for hat making but it is difficult to work. Botanically, the *mocorra* is known as *Astrocaryum trachycarsum.* It is a plant with a smooth, hard, thorny bark and leaves as long as 12 feet. Straws obtained from these leaves are long enough to complete a hat without splicing, but they lack the whiteness

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of *toquilla* straw. *Mocorra* fibers are also employed in the weaving of hammocks.

Material from the *toquilla* plant which is not suitable for hat weaving is used in the manufacture of baskets, mats, glass holders, table spreads, purses, cigarette cases, doilies, and other articles. Brooms and brushes are sometimes made from the fibers obtained from the *toquilla* leaf stems.

In different areas the quality of *toquilla* straw varies. Its price depends on length, thickness, color, locality of production, and the number of threads in each strand. Because of climatic conditions, the fibers occasionally become moldy, thereby lowering the value and quality of a hat. Hats or fibers thus damaged seldom, if ever, reach export channels.

How the Hats Are Made

Usually woven over a wooden block, the Panama hat begins to take shape at the center of the crown. To avoid piecing, long straw is used in this operation. The weavers work outward and downward. When finished, the crown center is held in place by a heavy stone until the hat is completed. Working about 4 hours a day, weavers may complete an inexpensive hat in anywhere from 1 to several days. For the finest hats, however, a period of from 3 to 6 months may be required.

Contrary to popular belief, Panama hats are not woven under water. Such treatment would be injurious to the *toquilla* straw. The belief that the hats are made under water may have come from the fact that since the fibers are more flexible when wet, weaving is usually done in the humid hours of early morning or during a rain. In addition, while plaiting the straw, the weavers constantly moisten their fingers.

Panama hats are purchased by exporters' agents at local markets. The better-quality hats are very often contracted for by the commission agents long before the hats are finished and a small advance payment is made to the weaver as soon as the center of the crown is finished. Although the crown, at this stage, is about the size of a silver dollar, the buyer can readily determine the quality of both the fiber and the workmanship.

The hats are washed, bleached in sulfur fumes, and dried in the sun. The sulfur is usually obtained from nearby volcanoes and sold to the hat makers. The hats are blocked by laying four hats at one time on rounded stones and pounding them with a wooden mallet. The brims are trimmed, the edges bound, and all stray ends fastened so that they cannot be seen. Finally, the hats are placed over wooden forms, held in place by a wooden ring slipped down over the crown, and ironed. The moderately priced hats are carefully graded and baled for export, while the finest hats are individually packed.

The quality of a Panama hat is determined by the number of rings, those with the largest number of rings grading highest. The best hats are as soft as linen and will wear for years. They are so flexible that they may be rolled without damage and since the inside surface is as smooth and neatly finished as the outside, the finest hats may be worn inside out. Good-quality hats are water resistant, show elasticity, uniformity, and fineness of straw.

As a final step the hats are pressed smooth with a hot iron, graded, and baled for shipment.

Where the Hats Are Made

In Ecuador the better-quality hats are produced in Manabi Province in the towns of Montecristi and Jipijapa. The hats are usually known by the name of the town in which they are produced or they may be named after the province.

The finest hats come from Montecristi, which is located about 6 miles from the port of Manta on the Pacific Coast. Lying at an altitude of about 350 feet above sea level, Montecristi has a climate that is favorable to the growth of the *toquilla* plant. It has a population of approximately 8,000 people and in the majority of families from one to six persons are engaged in the hat industry. Jipijapa, also noted for its fine hats, is located about 80 miles from Guayaquil and has a population of over 20,000. Most of the hats made in Montecristi and Jipijapa are men's hats.

The majority of women's hats are made in Cuenca, one of the most important cities in southern Ecuador. Cuenca was founded in 1557 by Gil Ramírez Dávalos. With a population of more than 55,000, Cuenca is located in the highlands and lies at an elevation of about 8,500 feet above sea level. Normally Cuenca manufactures some 150,000 dozen hats annually and many unfinished hats are brought in from surrounding areas and there finished.

During the depression, beginning in 1929, competition from cheap hats manufactured in the Orient and in Italy caused a decline in the Panama-hat industry. However, since the outbreak of the present war, with the resultant loss of these overseas sources of supply to the Western

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Grasslands of Argentina

The grasses growing in a country's pastures have a great influence upon the kind and number of livestock which may graze there. The grasses found on the pampas in Argentina have played a large part in that country's leading industry.

by A. T. SEMPLE

The humid grassland prairies of Argentina include nearly all of the Province of Buenos Aires, much of the southern half of Santa Fe and Córdoba Provinces, and the northeastern corner of La Pampa Territory. These prairies are known as the Pampa. North and east of the Pampa, between the Paraná and Uruguay Rivers, are located the Provinces of Entre Ríos and Corrientes, which are known as Mesopotamia and are also largely humid grazing lands. The grassy pampas of these two areas form the great grazing country of Argentina.

During the month of April 1943 the author traveled over these grasslands to determine the approximate relative importance of the principal native and introduced species of grasses and legumes. More than 220 pastures were examined. At intervals of about 20 miles along the highways we stopped and made careful estimates of the percentage of total vegetation or ground cover which each species constituted. There were 130 of these stops, and at each one at least 2 pastures were examined, one on each side of the road. In a few cases, at division or boundary fences, there were 3 or even 4 pastures.

Three of these Provinces—Buenos Aires, Entre Ríos, and Corrientes—contained in 1942 well over 18,000,000 cattle, which was 58 percent of all the cattle in Argentina, and nearly 23,000,000 sheep, approximately 45 percent of all the sheep. The cattle of Corrientes, Entre Ríos, and the eastern and southeastern parts of Buenos Aires are mostly breeding herds, producing steers to be fattened on alfalfa pastures, principally in the western part of Buenos Aires.

Mr. Semple took part in cooperative investigations of the Bureaus of Plant and Animal Industry and from 1935 to 1943 helped direct the work of the Soil Conservation Service on grazing lands. While working on the Food Procurement Program of the Foreign Economic Administration in 1943 he spent nearly 2 months in Argentina.

All pictures used with this article were furnished by courtesy of Don Stoops.

Most of the chilled beef exported from Argentina is produced in the western part of Buenos Aires. The area of the three provinces is comparable to that of Missouri, Illinois, and Iowa.

This part of the pampas is humid, with well-distributed rainfall varying from 24 to 44 inches annually. While severe droughts do occur occasionally, as in 1942-43, it is one of the best livestock sections of the world. The city of Buenos Aires, in the center of the area, has an average summer temperature almost identical with that of New York City. Since the average winter temperature is nearly the same as that of Charleston, South Carolina, cattle and sheep can be kept on pasture the year around with little or no harvested feed. Most of the soil is black and fertile. On the alfalfa pastures of the western part of Buenos Aires, where steers are fattened without grain, 1 steer is customarily carried on 1½ to 2 acres.

Soil Problems

Since most of the land in Buenos Aires and the southern part of Santa Fe is level, open or porous, and well supplied with organic matter, nearly all the rainfall goes into the ground. Hence, there are few drainage ways and water-erosion problems, except in the low hills and mountains in the vicinity of Tandil and Bahía Blanca. In western Buenos Aires wind erosion is serious when sandy land is plowed or is grazed too closely or when less-sandy soil is kept in cultivation too long.

More than half of the fertile pampas and a large part of the western and eastern sections of Buenos Aires are in pasture. Only in a small part of the livestock and wheat belt of southern Buenos Aires, in the corn belt of the northern part, and in southern Santa Fe is more than half of the land in cultivation. In a large part of the region it has been more profitable to keep most of the land in pasture to produce meat and wool and, more recently, butter and cheese, for export than to compete with the cities for the labor necessary to produce cultivated crops. Because of this and for other reasons the pastures have been maintained, and dairying and hog production have increased rapidly in recent years.

Grassland regions of Argentina visited by the author.

In Entre Ríos, where low hills and gentle slopes are common, there is serious need for conservation measures. Fortunately from 50 to 80 or even more percent of the land is kept in pasture. On land that has been cultivated too long without adequate measures to maintain the organic-matter content and to control the runoff, accelerated erosion is evident, especially northeast of the Paraná and in the hilly land in northeastern Corrientes, where the clean cultivation of yerba maté and of tung groves is carried on. Elsewhere in Corrientes most of the land is flat and poorly drained and is largely in grass or scrub forest.

Dominant Grasses in Buenos Aires Province

In the low flat lands in eastern Buenos Aires, between the city of Buenos Aires and Vidal, salt grass (*Distichlis spicata*) constituted an average 27 percent of the coverage in 8 different pastures, *Paspalum vaginatum* 31 percent, *Panicum gouinii* and *Stenotaphrum secundatum,* 16 and 12 percent respectively. Here livestock are raised mostly without forage crops, and little land is in cultivation. Farther south the species were bur clover, dallis grass (*Paspalum dilatatum*) and *Stipa papposa* 7 and 15 percent, with some rye grass and *Stipa hyalina.* In several closely grazed pastures there was considerable fine-leaf grass which could not be positively identified.

Between Juarez and Carhue, where nearly all the native sod has been broken for grain production, few native-grass pastures were found. Much wheat was being drilled that April. The owner of an almost pure stand of *Eleusine tristachya* said that it had volunteered, following small grain, in 1942 and that he valued it highly for pasture. It is reported to be resistant to trampling and was obviously resistant to close grazing. Weeds, with a high percentage of thistles, were bad, averaging 30 percent of the coverage in the 26 pastures examined. No alfalfa was growing in this area because of the heavy soil, which is shallow and underlain with caliche.

Throughout the southern part of the province almost a third of the pastures contained about 5 percent of a dense bunch grass, probably *Aristida pallens,* which is a serious pest. The long, slender, erect leaves, which are rough like files and have ends as sharp as needles, are irritating to the hands as one passes the clumps. In pastures where there is a good supply of other feed this grass is untouched, but where feed is scarce *Aristida pallens* is grazed closely by sheep in spite of the sharp points. Farmers had tried burning it off and digging up the clumps. The latter method was effective but costly.

Alfalfa for Steers

In some sections of the western part, where the soil is deep and sandy, about half of the pastures are alfalfa. Wind erosion is serious, with blowouts and many dunes, some of which are quite active. These plains are similar to the Great Plains in southern United States in that grass has been plowed up. Some areas are fenced off because they are not safe for grazing. To protect the roads from becoming blowouts partially filled with drifting sand, many windbreaks have been planted, with hedges so closely spaced on both sides of the road that cars can barely pass.

Alfalfa pasture in the southwestern part of the Province of Buenos Aires, typical of that on which large herds of steers are fattened for market.

The alfalfa pastures are 90 to 98 percent pure stands. Alfalfa which used to hold considerably longer now lasts only 6 to 8 years. The other pastures are poorly drained areas, having almost exclusively salt grasses (*Distichlis spicata* and D. *scoparia*), with star-grass (*Chloris* spp.) on the better-drained areas which have lost their stands of alfalfa through plowing.

In the vicinity of Rivera on blowout land a valuable sand grass was growing thickly in bunches about 2 feet high. It is probably *Panicum racemosum*, though positive identification could not be made since no plants were found in flower or seed. There were also many sandburs (*Cenchrus pauciflorus*). Weeds occurred in only about half the pastures, with an average of approximately 13 percent of the coverage.

Along the highway from Trenque Lauquen to Nueve de Julio—the approximate center of the "chiller-steer" fattening area—of the 17 pastures examined 4 contained considerable alfalfa, 6 contained bur clover, 6 had Bermuda, 5 had salt grass or small grain, and in 6 brome grass (*Bromus catharticus* or *B. cebadilla*) was most often associated with bur clover. Weeds averaged 30 percent. While alfalfa is undoubtedly the most important forage for fattening steers, far from all the pastures were alfalfa. A great deal of it had been killed by the drought and replaced by annuals such as bur clover, cebadilla, crab grass and other weeds. In addition to the steers there are many breeding cattle, which enable the operators to use a greater variety of crops in rotation and thus reduce the heavy risks that concentration on steer fattening alone would involve.

Northern Pampa

In the northern part of the Pampa between the city of Buenos Aires and Rosario, livestock, alfalfa, corn, and flax are the principal products, and the pastures consist largely of introduced species. Of the 55 pastures examined, 12 averaged 23 percent of alfalfa and 32 averaged 26 percent of bur clover. Thus bur clover occupies more than twice as much ground as alfalfa, with Bermuda grass, rye grass, and cebadilla also being important.

Brushy range in Entre Ríos Province, which provides pasture for breeding cattle.

The pastures sampled in the immediate vicinity of the city of Buenos Aires showed a high percentage of weeds, bur clover, *Paspalum distichum, Stipa hyalina* and *S. papposa.* Only one contained Bermuda grass, but there it amounted to 60 percent. Most of the land within a radius of 50 miles of the city is devoted to dairying and truck growing.

White clover, which was noted in only four pastures, had suffered greatly from drought and had not had time to recover since the beginning of the rains about 6 weeks before. Very little of the valuable Sudan grass was found. Even the stubble fields of low carrying capacity, where no sown or volunteer grasses or clovers had become established, were being used to help bring the cattle through the drought.

Corrientes

In Corrientes 33 pastures were examined in the south-central and northeastern parts, from Sauce to San José. The country here is low and flat, poorly drained, and has light-colored soil. Practically no land is in cultivation except for yerba maté and tung groves in the extreme northeastern part. The principal grasses observed were various *Andropogons* and *Paspalums,* and a bunch grass (*Andropogon lateralis*) which grows about 3 feet high. Burning is a common practice, only a part of the grass in one pasture or on one estancia being burned at a time so that sufficient grass is left to carry the cattle until the new growth becomes available. There are few sheep where these tall coarse grasses predominate.

Near Santo Tomé, pastures were occupied by a tall bunch grass, *Sorghastrum agrostoides,* related to the Indian grass of Kansas, and by *Paspalum plicatulum* and members of the genus *Axonopus,* to which the carpet grass so common from southeastern Texas to eastern North Carolina belongs. The presence of *Aristida pallens* and *Eragrostis bahiensis,* neither of which is palatable, may indicate over-grazing.

In the southern part of the province shorter, finer, and more palatable bunch grasses are common, such as *Chloris ciliata* and *Paspalum notatum,* which is known as Bahia grass in the United States. There is also some *Andropogon laguroides* common throughout the pampas, which is much finer and more palatable than the *Andropogons* of central and northern Corrientes, where the pastures are heavily stocked with cattle and sheep.

In a few pastures near Sauce a small amount of *Bouteloua megapotamica* was found, a grass which reminds one of side oats grama. Here, where burning is not so universally practiced as in the north, weeds were common.

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The California of South America

Central Chile and California, south and north of the Equator, are alike in many ways. On the exact reversal of seasons of the year Chile can capitalize in the production of off-season crops for northern markets.

by JAMES PARKER WILSON

Chile and California, approximately the same distance south and north of the Equator, show striking resemblances. If a California rancher were to settle in central Chile he would feel very much at home. Not only the geographic and climatic conditions but the agriculture, forestry, and livestock industry are quite similar. So also are the history, customs, traditions, types of people, and the manner of living in Chile much the same as those which existed in colonial California and exist there today.

From citrus groves one can see the snow-capped peaks of the Andes Mountains.

Chile, like California, has a coastal range and a rich Central Valley filled with fruit orchards, vineyards, vegetables, and other food crops. In place of the Sierra Nevada Range, there are the towering Andes to form a backdrop for the entire eastern frontier of the country, from the arid north through the rich Mediterranean-type central agricultural region down to the cold, windy, southern regions of the sheep-raising lands of Aysen and Magellan. The central part of the country vies with California in its cool, dry climate and scenic beauty.

Mr. Wilson is at present serving in Italy for the Department of State. Prior to his appointment he had served since 1941 as Agricultural Economist at the American Embassy in Santiago, Chile.

There are, also, the same sharp contrasts. From citrus groves one can see the snow-capped peaks of the Andes Mountains and from wide fields of grain can drive to dense forested regions only a few miles away. The same is true of the systems of farming. There are baronial estates or *fundos,* on which antiquated farming practices are in use. Next to them are modern corporations or private farms with a high degree of mechanization and using the most modern technical methods in production and management. These contrasting conditions would seem unusual to persons accustomed to certain parts of the central, eastern, and southern regions of the United States, where the landscapes and types of farming vary much more gradually from place to place.

Contrast in Seasons Important

The seasons are, however, in exact reverse in the two countries. Spring begins in March in California; September, October, and November are the spring months in Chile. Summer in December, January, and February would seem strange to a North American, as would autumn in March, April, and May, and winter in June, July, and August.

This difference in seasons has been a real asset to Chilean farmers and is likely to become increasingly important.

Young deciduous fruit orchards are found throughout Central Chile.

Their perishable farm produce, especially fruit crops, such as table grapes, peaches, and Honey Dew melons, come into bearing and are picked and shipped to the United States and other Northern Hemisphere markets during the off-season when the northern regions of the world are shivering in mid-winter weather and before or after the California or Florida crops are ready. In normal times, Chile is able to supply, in a largely non-competitive way as far as North American producers are concerned, a variety of these food products, especially perishable fruits and vegetables, which would not otherwise be available in the United States in abundant supply for consumption in their fresh state.

Typical irrigated valley in the semi-arid northcentral zone. Lombardy poplars divide fields and pastures.

An increase in this exportation of perishable off-season farm products may well be one of the best methods of increasing trade between the two countries in line with the basic economic principles of the Good Neighbor Policy. Such increase would help Chile to cushion post-war adjustments and to fall back with more assurance on its agriculture, which is the basic industry of the largest single segment of the population of the country. The effects would be particularly beneficial if copper, nitrate of soda, iron, and other mineral exports should decline when conditions become normal again after the war.

Growing Importance of Diversification

More than ever before, the farmers and officials of Central Chile are realizing the necessity of diversifying the agriculture of their unusual country. Even today, nearly every type of agriculture known to Europe and North America is to be found in Chile. There are grazing regions which are like those in the Alps of Europe and the Rocky Mountains of the United States; dairying regions like those of the Low Countries and Scandinavia, and of Wisconsin and Minnesota; wheat-growing regions like those of the Danube Basin of Europe and the Central States of the United States, though on a smaller scale; and even rice-growing regions like those in Italy and around the mouth and lower reaches of the Mississippi.

Chile is noted for its specialty crops, which are similar to those produced in the Mediterranean region of Europe and in California and other regions of the U. S. Pacific Southwest, and in Florida. These crops include oranges, lemons, and other citrus fruits, deciduous fruits, avocados, cherimoyas, papayas, wine and table grapes, and various kinds of melons, as well as raisins, prunes, and other fruits which are used for dried fruits; several kinds of nuts; and many truck vegetables, such as artichokes, asparagus, and onions. Some eminent plant explorers believe Chile to be the original home of the potato and the peach strawberry. Potatoes grow wild in the southern lake region and on the great green Isle of Chiloé. In fact, Chiloé is known as "the Ireland of the Southern Hemisphere."

The agriculture of the country has a complex geographic and soils pattern which is eminently suited to an intensive rather than an extensive type of agriculture. From Arica in the north to Puerto Montt in the south, a distance of about 2,000 miles, occur discontinuous strips of arable land along the coast, set apart from the interior by the hills or mountains of the coastal range. All the streams and rivers of the country run from east to west, from the high Andes in the east down into rich narrow valleys. They cut through the coastal range and flow, always at a rapid rate, into the Pacific Ocean, furnishing the irrigation waters for northern and central Chile.

The trend toward diversified agriculture is necessarily gradual. In Chile as elsewhere in the world some outmoded colonial farming practices, systems, and traditions continue. These practices have protected the system of large land-holdings which, with a number of outstanding exceptions of course, are apt to be inefficiently operated when measured by the most modern standards of scientific farm management. In times past, the ranches, because of insufficient specialization, have provided a good living only for the landowners and hardly a bare subsistence for the country workers. They are slowly changing from the old extensive cereals-and-livestock system to the more intensive growing of fruit, of medicinal, industrial, and related plants, and of truck vegetable crops. Dairying also is being developed. The result in Chile should be, as in California, a higher net return per acre and a better, higher standard of living for all.

BANANAS IN WARTIME

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because the banana has to be in the consumer's hands in a limited number of days after it is taken green from the tree. The foreman of the plantation gets his shipping orders, and the harvest is on. Only stems of certain maturity are cut each week in each section of the plantation. A harvest gang consists of a cutter, a backer, and a mule man. The cutter nicks the trunk below the bunch causing it to bend and let the bunch down on the backer's back.

Then the cutter cuts the bunch from the tree and lops off the blossom end. The backer carries the bunch out to the pack trail, where it is loaded on a mule, and after a load is accumulated the mule carries it to the nearest railroad loading station. Here trainloads are accumulated and loaded for shipment to the port where a special banana ship is waiting. About 85,000 bunches are loaded in a hold built especially for this purpose, and soon the ship is under way.

On the ship, special equipment has been installed and care is taken to see that the fruit is maintained at the proper temperature and humidity. This is necessary in order to control the ripening process and insure arrival of the fruit at its destination in good condition. In recent years a great deal of mechanical equipment is employed in order to speed up loading and unloading of ships, railroad cars, and trucks, and in handling of fruit in ripening rooms and storage places.

The process of harvesting, handling, shipping, ripening, and distributing bananas in the Western Hemisphere has been developed through long years of experience and scientific research. It is the only way high-quality perfect fruit could be made available to the large numbers of American consumers. One of the most recent developments is boxing of bananas for distribution after they leave the ripening rooms. Nowadays the consumer seldom buys bananas from a stem hanging in the retail store. He buys by the pound from select hands beautifully displayed on the retailer's fruit stand. The fruit is in excellent condition and is a real treat in these days of rationed foods.

GRASSLANDS OF ARGENTINA

(Continued from page 72)

Entre Ríos

In the northwestern part of Entre Ríos, the outstanding species were bur clover, *Stipa hyalina, S. papposa,* dallis grass, Bermuda, *Chloris ciliata,* and *Bouteloua megapotamica.* In many pastures weeds occupied from 20 to 50 percent of the ground.

In the northeastern part of the province *Chloris ciliata, Tripogon spicatus,* and Bahia grass were the most common species, with *Eleusine tristachya,* and species of *Eragrostis, Sporobolus poiretii, Panicum* spp., and *Aristida pallens* occurring in considerable quantities.

The southern part had a much greater variety of grasses, with fewer outstanding native species. Bur clover and rye grass made up a large part of most of the pastures. This is to be expected since most of the land has been plowed for crops and a large part is now devoted to small grains, with some corn, sunflowers, and alfalfa. In addition to the native species, such as *Eleusine tristachya, Andropogon laguroides, Stipa hyalina,* dallis grass, foxtail (*Setaria* spp.), *Eragrostis lugens,* and *Sporobolus poiretii,* many wild potato plants were blooming at a height of 5 to 6 inches, their tubers about the size of small marbles.

In the extreme southern part of Entre Ríos most of the land is swampy and tall coarse grasses predominate. Since much of it was under water at the time of these observations no satisfactory identifications could be made.

Obviously, the data and observations presented here are not conclusive. In order to make completely accurate determinations, the provinces would have to be covered more thoroughly and at various seasons of the year. Such information about the grasses growing in the pastures where Argentina's cattle graze is, however, valuable in solving problems of food production and distribution and in determining accurately and quickly the results of extreme weather conditions, like the severe drought from October 1942 to February 1943 which covered most of the summer growing season.

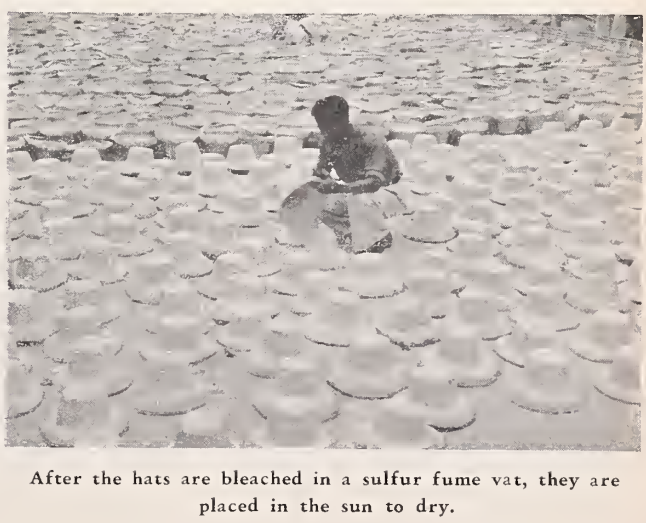
NOTE: A complete table showing the number of pastures examined, common and scientific names of grasses, pastures where they were found, the average percentage of cover, and range in percentage may be obtained upon request to AGRICULTURE IN THE AMERICAS.

PANAMA HAT INDUSTRY

(Continued from page 69)

Hemisphere, the industry has prospered. New styles and colors have been introduced and the industry shows new life. Especially popular is the newer open-weave Panama hat which offers lightness and better ventilation than the standard Panama.

Panama hats contribute much to Ecuador's economy. From 1938 to 1942 an average of 1,500,000 hats were exported annually from that country, 65 percent going to the United States. This handicraft industry, which has remained essentially unchanged in its methods of production since Panamas first became popular almost a century ago, has survived through the years, finding a market not only in the United States but in other countries as well.



After the hats are bleached in a sulfur fume vat, they are placed in the sun to dry.

ALONG THE *Agricultural Front*

▲ Peruvian Government Protects Vicuñas

The importance which Peru places on the vicuña in its governmental economy is indicated by the establishment of two projects in the domestication and raising of vicuñas. One of these projects is a model farm, Granja Modelo de Puno, located at Chuquibambilla, in the Province of Melgar, a little more than 13,000 feet above sea level. The farm has fields enclosed by tall wire fences. In one of these fields it maintains vicuñas which were acquired from wild flocks when only a few days old. These animals have adapted themselves to their environment and are producing offspring. The other farm is located at La Raya, between the Departments of Cuzco and Puno, and includes llamas, alpacas, and guanacos, as well as vicuñas. Here is carried on a study of systems of pasturing, selection of breeds, crosses, diseases, and other problems.

In addition to the government's projects, private attempts to domesticate the vicuña are being carried on, with encouragement of the government. One of these, begun in 1919, is the Paredes ranch, known as Hacienda Calacala, in the Department of Puno. By 1943 the Paredes flock consisted of more than 300 animals.

Legislation to protect this small member of the camel family, which runs wild in the Andes Mountains at altitudes from 13,000 to more than 16,000 feet and which produces the finest, softest kind of wool, began in 1825. At that time Simón Bolívar issued a decree that a reward of one peso would be given for each vicuña tamed. A second decree in the same year prohibited the killing of vicuñas. Various decrees have prohibited the exportation of vicuña wool, until in 1936 it was permitted under government supervision.

At the present time it has been estimated that there are approximately 50,000 vicuñas in Peru.

▲ Rural Agricultural School at Pirassununga

The first school in the State of São Paulo's program for the erection of 10 schools for the teaching of rural agriculture is practically completed. It is located at Pirassununga. The project is to teach the boys from the rural laboring classes practical agriculture with almost no attention to books or theory, fitting them for careers as foremen on large estates or as small independent farmers. The boys are to be taught by performing actual agricultural operations under the direction of trained supervisors. The government is to supply food and clothing during a 3-year period.

The school has 6,000 acres and calls for 400 boys between the ages of 15 and 25. The main building, which includes the dormitory, dining hall, and part of the administrative offices, is practically completed. The teaching staff and several boys are already at work and agricultural operations, such as the planting of beans, rice, and forage crops, are already under way. The buildings are solidly built, in colonial style of architecture, but the furnishings are simple. The formal opening of the school will probably not be held until the President of the Republic can be present.

▲ Colombia to Build New Slaughterhouse

With the announcement that the *Instituto de Fomento Industrial* has decided to finance the project, plans for the erection of a slaughterhouse in Villavicencio, Colombia, on the Meta River south of Bogotá, seem about to materialize. The prospectus, plans, and estimates have been drawn up by the Colombian Association of Cattle Growers and submitted to the *Instituto*.

The proposed slaughterhouse will have an initial capacity of 100 head of cattle per day, to be increased later to 200, with refrigeration capacity for as many as 400. It will be designed to permit maximum use of waste products. The bones, hides, hoofs, and horns will be used by the *Instituto de Fomento Industrial* for its new fertilizer factory and will contribute to the refertilization of the badly depleted soil of the western llanos. Biological and biochemical laboratories will also obtain valuable materials from the waste products.

The need for a slaughterhouse in Villavicencio has long been felt, since the 40,000 head of cattle which are driven annually from the llanos to Bogotá, a distance of nearly 76 miles, arrive in poor condition. Refrigerator trucks are planned to transport the meat from Villavicencio to Bogotá.

▲ Tannin From Mangrove Bark in Brazil

An industrial firm in Brazil plans to begin shortly the collection of mangrove bark as a new source of tannin. Extensive stands of mangrove trees are located in the coastal area between Belém, in the State of Pará, and São Luiz, in the State of Maranhão. Approximately 10,000 tons of mangrove bark is expected to be available in this section each year without seriously depleting natural stands. The mangrove in this area is said to be *Rhizophora mangle L.*, called *mangue preto* or *mangue vermelho* by Brazilians.

According to the plan, trees will be cut during low tide and bark stripped from the trunk and branches. The bark will then be transported to drying sheds, where, after about 2 weeks of natural drying, it should be ready for kiln drying and rough grinding. This roughly ground material will be packed in uniform bags with the results of individual tannin-content tests clearly marked on the tag. Prices will probably be based on a tannin content of 32 percent soluble material.

▲ Pyrethrum Planted in Antioquia, Colombia

As a result of experiments carried on by a representative of the Office of Foreign Agricultural Relations in conjunction with the local Department of Agriculture, the soil in the Department of Antioquia, Colombia, has been declared suitable for the cultivation of pyrethrum. Plantings have been made at the agricultural experimental stations at Ríonegro and Yarumal.

APRIL 14 PAN AMERICAN DAY

April 14 is Pan American Day, a day set aside by the Governments of all the American republics to emphasize the political, economic, and cultural unity of the nations of the Western Hemisphere. The theme selected for this year, the fifteenth anniversary of the day, is THE PEOPLES OF AMERICS, Independent—Interdependent, Neighbors in a World of Neighbors.

Teachers and group leaders may secure material and suggestions for programs, including school plays, music, and films, from: Pan American Union; Office of the Coordinator of Inter-American Affairs; Division of Inter-American Educational Relations, U. S. Office of Education—all of Washington, D. C.

SÃO FRANCISCO RIVER BASIN

(Continued from back cover)

sailing craft of from 1 to 10 tons capacity operate the full navigable length of the river and its tributaries. For about 1,000 miles inland from the mouth a steady trade wind blows continually against the current of the São Francisco at a rate of 8 to 10 miles an hour. Few great rivers have this natural aid to river transportation in both directions, current one way and wind the other.

If the São Francisco had been open to navigation from Pirapora to the Atlantic, the basin might have achieved its productive possibilities, which in turn could have made it the population center of Brazil. Navigation is broken 150 miles from the mouth by the Paulo Afonso Falls. Goods coming down the river must be transferred around the rapids and cataracts, which extend some 65 miles, by railroad or highway. From Piranhas, at the end of the rapids and falls, they may then be transshipped to Propria and from there sent by railroad to the port of Salvador, 350 miles to the south, or they may go on to Penedo and there be received by ocean steamers.

In addition to the railroad between Salvador and Propria, Salvador is connected by rail with the river port of Joazeiro, a distance of 360 miles. Plans have been under way for years to connect the central São Francisco area with Salvador by railroads, but recently highways are coming into use instead. In the vicinity of Belo Horizonte, in Minas Gerais, railroads and highways make an excellent outlet into the rapidly expanding industrialized São Paulo.

Resources

Livestock has long been the main resource of the basin, the number of cattle varying in different sections from 1 to over 50 per square mile. The Casa da Torre, one of the largest cattle farms in Brazil, was founded on the banks of the São Francisco and contained 600 square miles. Many cattle are still marketed by moving them on foot for distances of hundreds of miles. These long journeys, often over areas where only drought-resistant vegetation grows, cause so much loss of weight in the animals that they must be assigned to pasture lands of southern Minas Gerais for fattening. Here fertile fields are well fenced and cultivated and the pasture is lush, affording the cattle both a resting and a fattening period.

To many in the São Francisco Basin agriculture means the castor beans, cotton, and manioc which they export, and the corn, beans, and squash which they raise for local consumption. Only a few additions, such as cantaloupes, tomatoes, cucumbers, green peppers, and grapes, are made to this list according to the locality and the season.

The only product to reach the outside world from the *sertão* for centuries had been cattle, including some 30,000 hides, but in recent years figures indicate exports of babassú nuts, tobacco, rubber, Malva fiber, salt bacon, corn, dried fish, cotton, castor beans, coffee, manioc, and fruits.

Minas Gerais has a wide variety of agricultural products, the most important being coffee, tobacco, beans, corn, rice, and cotton. Milk, butter, and cheese are also produced on a large scale.

In Baía, cacao is the most important product, though Baía ranks second among the world's producing areas of fine tobaccos, leading other States of Brazil in the export of tobacco leaf for cigars. Sugarcane, cotton, rice, coconuts, oranges, and corn grow there also.

Pernambuco leads the Brazilian States in the production of sugarcane. Cotton, coffee, cacao, corn, tobacco, rice, and manioc are raised, some of Brazil's heaviest production of manioc occurring in this State north of the São Francisco. Tropical and subtropical fruits, such as pineapple, mango, avocado, and cashew, are produced here.

In the State of Alagoas sugarcane, cotton, rice, pineapples, and tobacco are the chief crops. The first two are cultivated on a large scale. Cotton and sugarcane are the most important crops in the State of Sergipe. About half of the sugar plants of Brazil are located in the States of Sergipe, Alagoas, and Pernambuco.

Although *mamona* (castor bean) is not the most important crop, it is grown throughout the São Francisco Basin, mainly for market outside the Valley. Carnauba wax obtained from trees in the São Francisco River Basin is used in preparation of explosives and for other purposes. *Canhamo brasileiro,* which is Brazilian hemp, flourishes in the States of Baía and Minas Gerais, three crops a year being gathered. Caroá, a relative of the pineapple and one of Brazil's outstanding fibers, grows in the hinterland of Pernambuco and around the São Francisco River in Baía. It is hardy and easily cultivated. Mixed with fine cotton, caroá is used in making cloth, and the fiber goes into writing paper, bags, candlewicks, rope, and twine.

In addition to livestock and agriculture, the São Francisco Basin has various natural resources. Deposits of asbestos, diamonds, copper, gold, iron, lead, manganese, nickel, aluminum, silver, and chromium are found. The hydraulic energy within the basin has been estimated to be between 1,500,000 and 2,000,000 horsepower.

Conclusions

The rapid industrialization of southern Brazil offers increased demand for products of the São Francisco Basin. Oils are needed, and the castor bean is at least part of the answer. This drought-resistant crop can thrive over large areas of the basin where it does not already grow. More rice, cotton, and beans can be produced as soon as railroads and highways are developed to carry the products out. Steady winds blowing in the basin suggest a general use of windmills to pump water for crops. A wise use of water through building dams for irrigation and development of electric power, as well as extended credit to small farmers, diversification of crops, and increasing measures for health and sanitation could pay large dividends to the entire Valley.

Nas selvas do Brasil, a recent translation into Portuguese of Theodore Roosevelt's *Through the Brazilian Wilderness.* 328 pp., illus., maps. Ministério da Agricultura, Rio de Janeiro, Brasil.

Colonias y foresta (Colonies and Forests), Vol. I, No. 1, 1st quarter of 1944. Illus. Ministerio de Agricultura, Dirección de Asuntos Orientales, Colonización y Terrenos de Oriente, Lima, Peru. A new quarterly illustrated magazine, in Spanish, including in its first number laws on colonization and administration of lands in Tingo María, and agricultural articles of interest to people of Tingo María and that part of the country in general.

En el bajo Orinoco (On the Lower Orinoco), by Arturo Hellmund Tello. 286 pp. C. A. Artes gráficas, Caracas, Venezuela; 1944. The author has written of what he has seen and knows about—the rivers and trees, people, animals, products, dangers and joys of the region, and a steamboat trip.

Curaciones y atenciones de emergencia del ganado lechero, by Peruvian Ministry of Agriculture. 54 pp. illus. Dirección de Ganadería, Enseñanza Extensiva, Lima, Peru; 1943. Brief statements of preventive care and remedial emergency treatment of diseases of dairy stock.

America and the Americas, by Hubert Herring. 84 pp. Claremont Colleges, Claremont, California; 1944. Two lectures, one of them appraising past activities of the Americas, the other giving a forecast of future developments, in easily readable style.

An Invitation to Portuguese, by Margarita Madrigal and Henriquetta Chamberlain. 208 pp. illus. Simon and Schuster, New York; 1944. The authors have used a simple pictograph method to teach the names of such items as parts of a plant and of the body and face, animals, foods, and terms of buying, selling, and agriculture. A grammar section and a vocabulary are included.

Fun Learning Spanish, by Julie E. Weyse and Henriette M. Babin. 74 pp., illus. The Julie Naud Company, New York; 1944. This is an elementary text-workbook, giving simple rules and exercises for learning the Spanish language.

Prática de fazer feno, by Ezelino Amadio Falzone. 41 pp., illus. Serviço de Informação Agrícola, Ministério da Agricultura, Rio de Janeiro, Brasil; 1944. A discussion, in Portuguese, of the practice of making hay, including analyses of different grasses cut at various stages, with illustrated instructions on making and storing the hay.

Cuba Sugar Year Book (*Annuario azucarero de Cuba*). 168 pp., illus. Cuba Económica y Financiera, Habana, Cuba; 1944. A new edition, in Spanish and English, containing the Sugar Census corrected to date and informative data on Cuba. Several maps and tables are included.

Relatório de observações científicas no Brasil, by A. F. Camp. 18 pp., tables. Ministério da Agricultura, Rio de Janeiro, Brasil; 1944. The author discusses probable causes of a citrus disease in southern Brazil, with some general remarks on old coffee groves, soil impoverishments, and other points about agriculture in Brazil.

O cultivo do coqueiro anão (The Cultivation of the Dwarf Coconut), by R. Fernandes E. Silva. 37 pp., illus. Suplemento de Sitios e Fazendas, Rua Xavier de Toledo, 46, São Paulo, Brasil; 1944. A discussion of the culture, uses, products, varieties, and cost of production of the dwarf coconut.

A History of Latin America, by Daric R. Moore. 942 pp. Prentice-Hall, Inc., New York; 1944. This is a new edition of a standard work, long known in the field. It deals with European and American backgrounds, the conquest, colonial period, national development of each Latin American country and its present status.

O caroá (Fiber for rope), by Lauro P. Xavier. 270 pp., illus. Serviço de Informação Agrícola, Ministério da Agricultura, Rio de Janeiro, Brasil; 1944. A discussion of the history, culture, and geographical distribution of fiber for rope.

Editor's Note.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

AGRICULTURE IN THE AMERICAS — O. R. CARRINGTON, EDITOR

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Gifts of the Americas

THE SUNFLOWER

by JANE W. ROLLER

The sunflower, *Helianthus annuus L.*, well-known plant of back yards and fence rows, has spread from its native home in the Western Hemisphere to practically every section of the world.

The origin of the name sunflower is attributed not only to its appearance but also to the fact that the head, moving by imperceptible degrees, completes an arc each day from east to west, "following the sun" from sunrise to sunset. The Spanish name for sunflower, *girasol*, and the French name, *tournesol*, reflect this daily motion, while the Latin name, *Helianthus*, and the German *Sonnenblume* are derived from the sun-like color and shape of the head.

As with many of our economic plants which have been in cultivation for centuries, little is known about the exact origin of the sunflower. Botanists are unable to determine whether its native habitat was Mexico, Peru, or the central plains of North America. It has existed on this continent as a sturdy, unbranched, single-headed plant since pre-Columbian times, serving as a food for the early American Indian and his stock and featuring as a motif in his silverwork. As early as 1567 the sunflower was growing in Spain, brought, perhaps, by some padre or roving conquistador returning from expeditions in the New World. From Spain the sunflower spread throughout Europe. Today the plant is profitably cultivated in a great diversity of soils and climates around the globe.

Practically every part of the sunflower plant is utilized in some way. The oil-bearing, nutritive seeds clustered in the center of the head are used whole for poultry feed or ground for oil and oil cake. In Russia the large seeds of one variety are toasted and sold on the street corners and are as popular a delicacy as the peanuts and popcorn of this country. In other countries the whole seed is roasted and used as a beverage, and in parts of western Asia it is boiled and eaten as a cereal.

Sunflower oil is a light-golden liquid ranking close to olive oil in texture and flavor. It is used as salad or cooking oil, in the manufacture of margarine, and in canning fish. The oil cake remaining after the various grades of oil are expressed is highly valued as a stock feed, especially in Denmark, where sunflower oil cake supplies half of the concentrated ration for the dairy industry.

The North American Indian made meal of the sunflower seed and fed the large coarse leaves to his stock. Today the whole plant is often cultivated and cut as ensilage. The yield, comparing favorably with that of ensiling corn, is sometimes as high as 19 tons to the acre. The sunflower plants are cut and chopped while leaves and stems are still green, before the stalks become woody, and while the seeds are in the dough stage.

There is an unending list of products obtained from the sunflower. Both the yellow ray flowers resembling petals and the inconspicuous seed-producing disc flowers in the center of the head are an excellent source of honey. In parts of Europe the pithy seed receptacles are dried and made into blotting paper. The inner part of the stalk is used in the manufacture of fine writing paper and the outer stalk produces a silky fiber.

Vegetable fats and oils, important for complete nutrition and as raw materials necessary in some essential industries, present one of the greatest world shortages today. The principal oils of commerce came formerly from the warm regions of the world, many of which are cut off completely by the war. During the Spanish Civil War great areas of olive trees were ruined. To supplement the dwindling supplies of olive oil, Argentina has increased its production of sunflower seed from 5,000 tons to 500,000 tons. Canada increased sunflower acreage to aid in supplying a commodity formerly imported almost entirely from Argentina. Experimentation in sunflower cultivation in the United States has increased the yield of seed per acre from 50 or 60 pounds to 1 or even 2 tons, depending upon planting distance, spacing of rows, available water, and fertilizer.

As a crop, the sunflower needs little cultivation. Except for a weevil which attacks the seed, and its susceptibility to mildew during a wet season, the plant is singularly free from disease. The great leaves provide such dense shade that obnoxious weeds are unable to grow in the fields. For this reason the sunflower has been suggested as a rotation crop to rid areas of otherwise uncontrollable weeds. The greatest difficulty with it as a crop plant is that birds sometimes destroy the seeds before they are mature. They are a favorite food for our seed-eating wildlife.

The sunflower is a gift of the Americas to the world. Perhaps some day it will become even more deeply appreciated than it is now as a nutritious crop.

SÃO FRANCISCO RIVER BASIN—BRAZIL

by **R. G. Hainsworth**

The São Francisco River, called by this name since its discovery in 1501, is one of the large rivers in South America, although it is little known outside Brazil.

From the hills of Canastra in Minas Gerais the São Francisco meanders northward for more than 1,000 miles between mountain ranges parallel to the coast, over a level floor 15 to 20 miles wide at an elevation of 1,200 to 1,500 feet. It then turns eastward and flows over the Paulo Afonso Falls, known as the "Mother of Waterfalls," on its way to the Atlantic. The entire length of the river is 1,800 miles, and the basin includes an area of some 300,000 square miles with about 2,500 miles of navigable waters, including numerous tributaries.

Climate and Soils

The climate is subtropical except as modified by altitude. The average temperature is from 68° to 77° F., and the average annual rainfall varies from 30 inches in Pernambuco to about 60 inches in the headwater area. Rainfall is generally meager, poorly distributed, and largely unpredictable. The mountains on the east of the river act as a wringer against the moisture-laden easterly trade winds, thereby making a rain-shadow desert of the westward area.

Along the headwaters the climate is wet, with mild dry winters and hot rainy summers. The soil is a red-brownish type, typical to damp tropical areas. The remainder of the river then passes into a zone of wet climate with a distinct dry but not cool season and equable temperature. The soil in this area is alkaline as far as the bend of the river, where a laterite, or red-earth, soil is found. From the Paulo Afonso Falls almost to the coast the soil is red podsolic, and along the coast the land is marshy.

Vegetation

Vegetation is predominantly tropical scrub forest, a formation of low scrub trees, broad-leaved and deciduous, the leaves dropping off during the dry season. At the head of the river on the west side of the basin in Minas Gerais, and in lower Baía, the grasslands called the tropical savannas are found. Tropical semi-deciduous forests, composed of large broad-leaved trees including a mixture of evergreens and deciduous species, are found along the coast in the States of Sergipe and Alagoas.

Population

Although the average population of the cities in the basin is about 25,000, Boa Vista has approximately 55,000, Aracajú 66,000, and Belo Horizonte, the largest city in the basin, around 220,000 inhabitants. The population is mostly European and Indian, with a mixed population having a large proportion of Negroes in a narrow strip along the coast and in the headwater section.

The *sertão,* a dry section in northern Minas Gerais and southern Baía, is occupied by a scattered and predominantly pastoral people, with a density of population varying from 2 to 10 persons per square mile. Most of the northern part of the area was peopled by frontiersmen from Baía in the eighteenth century, and the southern part was settled during the early nineteenth century by people leaving the declining gold fields of Minas Gerais. Living around widely scattered ranch headquarters, the people have few contacts with the outside world except for the salesmen who bring in manufactured articles on mule-back.

Transportation

Transportation on the São Francisco consists of several lines of small steamers. On the upper reaches of the river the boats are flat-bottomed, with a cargo capacity of 80 to 150 tons and a draft of about 2.5 feet, limited by the shallows and sand bars which occur at low-water stages. On the lower part between Piranhas and Penedo, where for about 150 miles the river channel is deep, several round-bottom-type boats make two trips a week. In addition to the steamers, many small

(Continued on page 77)

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NAMES & NEWS

Going to Costa Rica

Hobart E. Stocking, Geologist for the Petroleum Administration for War in Pittsburg, has left for Costa Rica, where he will teach geology in the colleges of engineering and agriculture of the National University and serve as Geological Adviser to the Costa Rican Government.

Mr. Stocking, who taught geology at the University of West Virginia before accepting the post at Pittsburg, is going to Costa Rica on a travel grant by the U. S. Department of State. He will remain in Costa Rica for 1 year.

Assigned to Peru

Andrew F. Freeman, Biological Chemist for the Office of Foreign Agricultural Relations, has been assigned to the Cooperative Agricultural Experiment Station in Peru. Mr. Freeman will assist with agricultural research and investigations designed to improve the production of strategic complementary crops.

Leaves for Brazil

Hans G. Sorensen, Senior Agronomist, Bureau of Plant Industry, Soils, and Agricultural Engineering, left recently for Brazil, where he will work with the cooperative rubber program in that country. During the last 5 years Mr. Sorensen has been closely associated with the rubber-plant investigation work of the Department of Agriculture.

To Direct Experiment Station In El Salvador

Nathaniel E. Winters, Office of Foreign Agricultural Relations, has been assigned to El Salvador to serve as Director of the Cooperative Agricultural Experiment Station. Prior to joining the staff of OFAR, Dr. Winters served with the Soil Conservation Service, with headquarters in Honolulu.

Returns to Dominican Republic

Howard F. Allard, Bureau of Plant Industry, Soils, and Agricultural Engineering, after conferring with officials of the U. S. Department of Agriculture, has returned to the Dominican Republic, where he is in charge of experimental plantings and investigations to determine the feasibility of rubber production from Hevea in that country. This work is being carried on under a cooperative agreement between the U. S. Department of Agriculture and the Secretary of State for Agriculture, Industry, and Labor of the Dominican Republic.

Visitor from Haiti

M. Louis Décatrel, Director General of Agriculture, Republic of Haiti, is visiting the United States for several months for the purpose of making special studies on the subjects of storage, warehousing, and soil and water conservation. During his stay here M. Décatrel will confer with agricultural officials of Cornell University and the U. S. Department of Agriculture.

Returns to Paraguay

Dr. Guillermo Tell Bertoni, Under Secretary of Agriculture of Paraguay, has returned to his country after several months in the United States. Dr. Bertoni was especially interested in various aspects of farm credit and agricultural research. While here, he visited agricultural leaders in a number of southern and western States.

Assigned to Central and South America

Dorothy E. Chapman, Agriculturist, Office of Foreign Agricultural Relations, is spending several months in Ecuador, Peru, and Central America, gathering information on the results of experiments in complementary crops which are being carried on at the Cooperative Experiment Stations of these countries. Later Dr. Chapman's material will be translated into Spanish and published for the use of small farmers in the various Central and South American countries.

Agriculture IN THE *Americas*

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Brazilian Coffee Goes To Market

Many articles have been written on the economics and politics of coffee but few on actual production practices. This article describes fazenda life in Brazil and the movement of coffee from the planting of the trees until it is exported.

by HENRY W. SPIELMAN

Brazilian coffee fazendas might be called "factory" farms. In the State of São Paulo, the world's largest single unit producer of coffee, there is one farm, near Mattao, which has 4,650,000 coffee trees. The average is perhaps 18,000 trees, on 60 acres, but there are many farms which have as many as 225,000 trees and employ many people. They have expensive processing equipment and investments of thousands of dollars.

The larger farms or fazendas resemble in many respects the Southern plantations of pre-Civil War days. The grounds around the homes are spacious and well landscaped. Hedges cut off the view of other farm buildings. Generally there are swimming pools, tennis courts, riding horses, and frequently landing fields for small airplanes. The house has a veranda, spacious living room, a dining room in which 20 to 50 people could be served at one time, and from 8 to 20 bedrooms, with modern bathrooms.

The fazenda or plantation owner usually has an equally large home in Rio de Janeiro, São Paulo, or Santos. Before the coffee crisis in 1929 many of them maintained homes in Paris. They frequently spent 3 to 6 months during the year traveling in Europe and educated their children in European schools. Since 1929 they have had to live nearer home and to find their entertainment within the country.

The workers live in houses furnished by the owner. Most of the houses are long brick buildings covered with plaster, from two to six families living in one building. Each family has a so-called apartment, which means a kitchen with an outdoor oven, a living room, and one or two bedrooms. A hydrant or well is furnished for each building and a tank to hold water for the laundry.

Each large coffee fazenda has a business center, usually located near the coffee-drying ground, including a general store, repair shop, school which offers work of the first 4 years, athletic field, sometimes a church, and occasionally a movie theater. Many of the products sold in the store are produced on the farm, among which is *aguardente,* a type of sugar-alcohol drink common in Brazil. Medical supplies are furnished through the store, and in cases of emergency a farm official will arrange medical service for

On most coffee plantations the weeds and grass are cleaned off by hand on an average of four times each season.

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The harvested coffee cherries are spread out on drying grounds, where they are turned frequently to insure uniform exposure to the sun.

the workers. The fazenda owner never buys things in the store but does all his buying in São Paulo or some other city.

In the "big house" two meals are served each day. Brazilians do not eat breakfast but only have coffee with milk and bread. The meals are of five to eight courses based principally on meat. The first course is usually soup, the second fish, third rice and chicken loaf, fourth steak with rice or beans, fifth a green salad, sixth cooked desert, seventh fresh fruit, and the meal is finished off with a small cup of strong black coffee. Wine is frequently served. Lower-income groups have rice, beans, and jerked beef supplemented with bananas and oranges.

Coffee field workers are paid by the day or by the number of trees they care for, which may run into the thousands. For harvesting and processing, workers are paid by the bag. Yearly family wages vary from $200 to $300 depending upon the number of workers in the family. Perhaps the rate of wages in 1945 will be somewhat higher because there has been a migration from coffee farms to the newer agricultural regions and to industry.

Practices in Coffee Production

All growers follow about the same practices in producing coffee. The best land in southcentral Brazil is planted to coffee even to the exclusion of cotton if the land will grow crops of coffee economically. The best coffee lands are the red clay soils, *terra rosa,* and *massapé,* found principally in the State of São Paulo but also in Paraná, Minas Gerais, and Goiaz. Most of the sections having these soils in São Paulo and Minas Gerais were planted to coffee during the first coffee boom, which ended in the early 1920's. Since then coffee has been planted on the light sandy soils of the western part of São Paulo, which supplies most of the coffee now on the market.

In Brazil coffee is always planted on newly cleared forest land. It is a tropical-forest plant. According to some botanists it was originally found in the jungles of Africa, perhaps along the Congo River. It grows best under conditions which resemble tropical forests at an elevation of over 400 feet.

The newly cleared forest lands have an abundant supply of decaying organic material covering the surface for a depth of 2 to 3 feet. The subsoil has the remains of roots from trees that have been growing and dying on the land for thousands of years. When planted on such soil, coffee trees grow rapidly and are usually in heavy production their fourth year.

Coffee trees are planted in holes 3 yards apart. The holes are about 18 inches in diameter and 2 feet deep. A handful of seed, from 10 to 20, are dropped in the bottom of the hole and covered lightly with dirt. The holes are covered with pieces of wood to shade the young trees until they push their heads up to the level of the ground. This amount of growth requires about a year. When the pieces of wood are removed, the trees are thinned down to 4 to 8; recently the tendency has been to leave only 4 trees per hole. After the first year the trees grow rapidly, the four stems merging into one at the base, and in about 25 years reach a height of 12 to 18 feet. If well cared

A 4-year-old coffee tree, showing the coffee cherries growing in clusters on the new branches.

for and fertilized regularly, they will maintain that height for from 15 to 25 years longer; but if not properly cared for, they gradually become smaller until at the end of 30 to 40 years they are only 6 or 8 feet high.

The ground around the trees is kept clean from the start by scraping with a heavy hoe, the number of scrapings required depending upon the amount of rainfall and the length of the growing season. Were the weeds permitted to grow, the trees would be difficult to find when they begin to show above the ground and the weeds would take much of the plant food that should go to the coffee trees. The rains usually stop early in April and weeds stop growing by the last of April unless the land is irrigated. About a month before harvest time the land around the trees is scraped for the last time and all trash piled in the middle of the rows.

Except for a few experimental plantings, coffee produced in Brazil, contrary to the practice in Central America, is grown in unshaded groves. The production per tree is somewhat higher for unshaded than for shaded coffee.

Recently, it has become customary to plant rice, beans, corn, cotton, mint, or castor beans between the rows of young trees during the first 4 years, in order to supplement producer income lost because of low coffee prices. Many times there will be a combination of two or more of these crops planted on the same tract of land with the coffee trees. Little additional work is required to care for these extra crops but they take moisture and plant food from the coffee trees and in the long run will probably lower yields and shorten the life of the trees.

Some producers raise cattle in order to obtain enough manure to fertilize all their trees once every 3 years. Animal manure is considered the best type of fertilizer because it most nearly approximates the organic material built up in a tropical forest. Coffee hulls are considered second best. Only small quantities of commercial fertilizers are used for coffee, as experiments at State agricultural stations indicate that they are inferior, for coffee, to organic fertilizers.

Coffee trees in Brazil usually flower three times each year, although in some years they may flower a fourth time. The first flowering, usually light, takes place in August; the second, usually heavy, in mid-September; and the third, light, in October. The flowers are white, with a faint odor.

The young coffee bean remains green until a month to 6 weeks before it is ripe. Then it turns red, which accounts for its being called a cherry. When the cherry becomes thoroughly ripe, it is brownish black and about the size of an ordinary cherry. Brazilian *moca* beans are improperly formed cherries. Only one bean in the cherry has developed and it has grown round instead of having one flat side as the fully matured bean has. *Moca* beans are usually found in the tops of trees or on the ends of branches where flowers are not completely fertilized.

Coffee fazenda or plantation homes are often spacious and have well-landscaped grounds.

Harvesting

Coffee cherries begin to be ready for harvest the latter part of May and harvesting continues through July, cherries from the three flowerings maturing during this period.

Picking is done by hand. The picker takes the fruit-bearing branch between his thumb and forefinger and strips off everything on it including the mature beans, green beans, and even many of the buds for next year's flowers and leaves. He drops all this on the ground and moves on to the next branch. When prices were higher, canvas sheets were spread under the trees to prevent the coffee from dropping on the ground, and on a few of the better-managed fazendas this practice is still followed. After a section of trees has been picked, the cherries are swept up. Some of the trash is separated from the coffee cherries by throwing them into the air and catching the coffee on a screen, the wind blowing the lighter material away and the finer particles falling through the screen.

While still in the field the coffee is put into sacks for hauling to the drying ground. There it is dumped into vats of water. Mature beans float and are carried off through a concrete sluiceway to be dried, while the rocks and green cherries settle to the bottom.

Processing

Coffee cherries remain on the drying ground from a week to a month depending upon the weather. When they first arrive, they are spread out on a large brick and asphalt floor in a layer 2 to 4 inches thick. In order that the cherries may dry evenly throughout, workers turn them frequently, exposing them to the sun about 3 hours in the morning and 3 more in the afternoon and gathering them into small mounds at other times. If rains threaten, the piles are covered with canvas.

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Balsam of Peru From El Salvador

From earliest times beautiful trees growing on the hillsides of El Salvador have been giving forth a healing balm. It is known throughout the world as Balsam of Peru.

by FREDERICK L. WELLMAN

Modern civilization has settled upon El Salvador. But out in the emerald hills, studded with blue and fuming volcanoes, things go on much in their own old timeless way. One feels this, as he learns of an ancient and important health-giving balm that comes from some of the most beautiful trees growing on those hills. This product went to Europe first in casks deep in the holds

The balsam is extracted by means of a hand-operated press.

of old Spanish galleons. Since they sailed from the port of Callao in Peru, it was called then and is still known as Balsam of Peru.

The Tree That Gives Its Life

The balsam tree is a forest monarch, with a mass of relatively delicate, shining, dark-green leaves often carried more than a hundred feet above the ground. Forest scientists class it as an upper-story tree. In crowded growth its crown is held high and flat to make every use of all the sunlight that can reach it. The trunk is slender and its branches ascend with graceful upward sweep. The bark varies considerably but in general is light- to dark-gray in color, with moderately fine reticulations. In El Salvador at least, it tends to be rather free from the mosses and other hoary growths that attach themselves to many species of trees in these regions. The bark on the bole and branches is quite tight in appearance, lacking excessive cork and scaliness.

More than a dozen scientific names have been applied to the tree by different botanists. This confusion is understandable as the tree is found in practically every country of South and Central America, including Mexico. Under these diverse growing conditions trees often show slight, though actually superficial, differences which have led botanists in separate countries to make name changes that would not occur if all the trees grew side by side in one region. Conservative botanists have lately given the balsam tree, no matter where it grows, one scientific name, *Myroxylon balsamum.* It belongs in the family Leguminosae and is related to such famous tropical trees as the Poinciana, the saman or rain tree, and the Giant Guanacaste. In El Salvador the tree is called by a large number of different names, the most common of which are: *Balsamo* or *balsamo negro,* by the Spanish; *hoitziloxitl,* by the Pipil Indians; and balsam tree in English. It is referred to with reverence and affection in El Salvador, because it is the tree that is tapped for the balsam of commerce. The industry in that country is the one with which the writer is most familiar.

Balsameros Tap the Trees

The Indians who specialize in tapping balsam trees are known as *balsameros* and are proud of their work. They form a sort of guild, and their position in it holds some prestige. To do the work a man must tramp over difficult terrain, he must work high up on the trunks of the trees and along their branches, and he must know how and when to tap. If there are enough trees, only large ones are selected, with trunks at least 18 inches in diameter. While much smaller trees may be tapped when balsam prices are high, they give less sap, are early weakened by tapping, and may soon die in the process. When tapping is started, it is usually continued until trees succumb. If, however, a tree is well matured before work starts, and if tapping is

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judiciously performed, it may live for a long time. Indeed, Indians can show you landmark trees today that provided balsam for their fathers and grandfathers.

The tapping process commences with removing, by means of a special chisel-like tool, a small "window" of bark near the base of the trunk of a tree and removing the bark down to the sap wood. These windows vary in size, depending on the dimensions of the tree and various other conditions, but are commonly from 3 to 4 inches wide and a little more than twice as long, with the length running up the trunk. The tapping window may be left to dry for a few days, or the bark above its upper edge may be given immediate treatment to induce the sap to exude.

Sap Must Be Made to Flow

Sap does not ooze from the bark of the balsam tree with such ease as the milky juices of rubber trees "weep" into a shallow, narrow, clean-cut groove. The bark above the window must be injured severely, either by heating or beating, or by a combination of both practices.

The most common method of bark injury in El Salvador, and the most spectacular, is through the application of fire. The *balsamero* believes that the best heat is that which comes from fire of balsam wood itself. So he ties with fiber a handful of stakes split from an old balsam stump. These are ignited on one end at a fire which has been built with balsam chips in a nearby clearing and is tended by a small boy, and the burning fagot is applied to the bark above the window. A grove that is being tapped is redolent for miles around with the odor of burning balsam.

Heating of the bark must be done with judgment. Even though sap is seen oozing from the bark during the time heat is being applied, great skill is needed to know when to stop. If the heating is too mild, the sap will not continue to ooze when it cools; if too much fire is used, the bark will be charred so that it will not give up a good quantity or quality of sap. At best, sap is not obtained in great profusion.

At just the right moment the hot fagot is taken away from the bark, out of which the sap has started to ooze, and thrown to a helper, who catches it with dexterity. The *balsamero* inserts an absorbent cloth under the edges of the bark along the sides of the window and affixes the top of the cloth to the upper rim. The sap seeps down from the injured bark above the window into the trap cloth. These trap cloths are collected when they become saturated, usually in from 10 to 20 days. At collecting time another window is cut out of the spent injured bark that is above the old window and continuous with it, and so on until long gashes or panels extend up the tree. Tappers never completely girdle a tree, for they know the tree would die if they did. Narrow strips of bark are left undisturbed between the long bare tapping panels, and as many as 18 of these panels may be made on larger trees. In a few weeks, the edges of the older tapped sections begin to heal and a roll of new bark piles up around the scar.

The work of the *balsamero* is often dangerous. Here he is applying a burning fagot above a "window" high up on the trunk of a balsam tree to make the sap ooze from the bark.

A Strong Man's Job

While tapping is still being done around the base of a tree, the task of a *balsamero* is easy. He stands on firm ground and can work with facility. In a few months, however, the tapping panels ascend beyond his reach and he has to climb, either by stakes sunk well into the heartwood of the tree or by ropes that he throws over the branches. If he uses the first method, he fits stout stakes of the soundest balsam heartwood into holes made deep in the tree trunk with primitive boring tools. He uses only balsam wood for these stakes, saying that stakes from other woods are "not friendly" when driven into a living balsam tree. Whether this is true or not, long-cured balsam-tree heartwood is extremely resistant to decay, the

bark of the living tree heals about the stakes, and they make almost permanent laddering for hands and bare feet.

Some *balsameros* scorn the use of stakes for climbing. With unerring judgment they loop strong ropes or lassoes of the best henequen fiber and throw them over the high crotch of a branch. Pulling themselves hand over hand up the ropes, they walk with their bare feet up the trunk of the tree to the tapping point. Here the ropes are tied, and the tapper can swing himself in the knot, facing the panel to do his work.

The deftness with which the *balsamero* carries on his profession high up on the smooth trunk of the tree is remarkable. He has to be strong and gifted with good coordination. The lesser parts of the balsam-gathering process are left for others to handle.

Extracting the Balm

The bark that is cut away to make the windows is put into a bag by helpers and, with the saturated trap cloths, is taken to the extraction center. This is under a thatched roof in an old established location in the forest. After dirt is brushed from the trap cloths, the bark and cloths are thrown into ancient rounded vats filled with water, which is kept heated over steady fires. The hot water loosens the sap absorbed by the cloth or the bark tissues so that the balsam can be squeezed out. After this hot bath, the materials are dipped from the vat and allowed to drain for a short while. Little sap escapes into the water and that which does run out sinks to the bottom of the vat,

Part of the extraction process involves boiling the saturated trap cloths and bark in ancient rounded vats.

where it is later dipped out in gourd bowls. The materials are still hot and dripping when they are folded in a cloth and placed in a press.

Most of the extraction presses are of the same primitive kind that have been used by the Indians since early times. The press consists of an exceptionally strong, coarsely woven bag, attached by stout cords of native fibers at one end to a movable beam of balsam wood, and at the other end to a solid post. By an ingenious arrangement the cords are so bound around the bag that they will squeeze it when twisted by a pole run through the movable beam. Great pressure is thus exerted by men at the end of the pole to draw the cords tight, and out of the bag drips the crude sap from which is refined the Balsam of Peru so well known in commerce.

The Balm

The product that comes from the forest extraction plant is a liquid heavier than water, varying in color from an opaque dark reddish brown to a somewhat brighter shade. It is bitter and slightly viscid, with a pungent, rather heavy odor which gives the impression of mixed fragrances from honey in the comb, vanilla, and cinnamon, combined with a slightly smoky tang. Although it lacks the delicacy, intensity, and sweetness of many of the attars and essences of the Orient and the Near East, it has been used with good effect in compounding, blending, and fixing fine perfumes.

The most important use of balsam is in medication. The ancient peoples of Mexico and Central America used it in their healing practices before the days of Columbus, and they still use it. The natives in the jungles of Peru have it as a component of the poison for their blowgun darts, a use which seems incongruous in the light of the many beneficent purposes which it serves. In El Salvador it is used in soaps that are said to have healing qualities, and in many drug preparations. Indeed, it is held to be a sovereign remedy. For centuries the balm has been considered by physicians in Europe and the United States of America as a standard ingredient of ointments, cough syrups, and dressings for application to slow-healing sores. Right now it is helping in military hospitals to alleviate the suffering of our wounded soldiers.

We shall probably never learn when or how its health-restoring qualities were discovered. We do know, however, that from the days of the early Indian medicine men people have recognized the blessing of this balm, which still comes to us from the hillsides of El Salvador and other Central and South American countries.

June 21 is the first day of summer in North America, and the beginning of winter below the Equator.

Helping Hemispheric Solidarity

Much is said today about hemispheric solidarity. Between Mexico and our Southwest, mutual contributions have long existed. An enthusiastic experiment in health cooperatives, actually working in New Mexico, may prove helpful in suggestions to other States and countries in this Hemisphere.

by CHARLES P. LOOMIS

Hemispheric solidarity must be based upon a mutual understanding of the cultures and traditions in the different countries and States occupying the hemisphere and of the contributions which each member of the group has made or may make to the cultures and traditions of the others. This holds true of Mexico and those Southwestern States which border it on the north.

Mexican Cowpunchers Contribute

One aspect of Mexico that has left an indelible impression on the rest of North American life is the Mexican cattle and horse culture. The skills, techniques, and equipment about which the cattle kingdom of the Great Plains of the United States was built came from Mexico.

Since the English language did not carry names for the items of this cultural heritage, quite naturally many Spanish words came into American and English speech. Any standard dictionary will carry the word lariat, which was what the English-speaking cowboy thought he heard when Mexican *vaqueros* and *charros* used the words *la reata* in talking of a throw rope. Lasso came from the Spanish *lazo,* chaps from *chaparreras,* hackamore from *jáquima,* quirt from *cuarta,* surcingle from *cíngulo,* cinch from *cincha,* stampede from *estampida,* and bronco from the Spanish adjective for rough or wild. These are all common words in horse vernacular today, as are also latigo, rodeo, remuda, tapadera, concha, honda, and corral, which are Spanish words taken over wholesale by the Western cowboy. In addition, there are such State names as Nevada, Texas, New Mexico, California, and Montana, and numerous place names to remind the Westerner of his Spanish heritage.

Not only in language does the Western cowboy owe much to the Mexican cow culture. The cradle of the cattle industry of the Great Plains was Southeast Texas. In this area, which was protected from the savage Indians of the Plains, who had also learned from the Spanish to ride, Southerners who knew little about the cattle industry learned from the Mexicans to become some of the world's most skilled and daring ropers and wranglers. After 1821, especially in the Colorado River Valley of Texas, they were able to handle Mexican broncos and Texas longhorns, both of which were among the toughest and most dangerous of their species. The Mexican *vaqueros,* or cow-herds, and *charros,* or glorified cowboys, had taught them to rope and ride Mexican style, and from then on Westerners rode "Western style," in saddles designed on the basic principle of the Mexican saddle with its large horn used for roping.

Those who have attended the Frontier Days Exhibition in Cheyenne, Wyoming, or the roundup in Pendleton, Oregon, and similar exhibitions in Mexico know that Yankee ingenuity has revised the original Spanish skills of the cowboy. Mexican *charros* exhibit their prowess in "tailing" cattle on the run by riding up from the rear, grabbing the cow's tail, reining off to one side and so throwing the animal off balance that it turns end over end. In place of this trick, the Yankee cowboy "takes the bull by the horns" when he rides up from behind to throw and pin him to the ground. Cow punchers have made many other changes in the original skills and equipment, but, like rope spinning and some kinds of rope tricks which were formally introduced into exhibitions in the United States by the Mexican *floreador* Vincenti Orespo about 1900, the cow culture of the West is basically a Latin American contribution. It spread over the entire Great Plains area as the Texas longhorn cattle were driven north to take over the ranges formerly controlled by the buffalo and the Plains Indians.

Few parts of the country have not been influenced by the Mexican cow culture if only through the "Westerns" on the screen and in book form. It is an important aspect of the Southwest as the proving ground for hemispheric solidarity.

Cooperation for Irrigation

The oldest cooperatives in this country were the irrigation-ditch associations of the Southwest. One sees the principles of democracy working in a meeting of ditch users in a New Mexican village when the ditch officials are being elected or a policy of the ditch association is being determined. Some people believe that the irrigation culture of the entire West was profoundly influenced by these Latin

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This flume carries water across an *arroyo*, or gully. Flumes, ditches, improvised dams, and other irrigation facilities were used in the Southwest long before Anglo-Americans had experience in irrigation.

American ditch associations which were built upon Indian experience.

The Southwest Contributes

The Latin American culture gave North American agriculture its cattle industry and much of its knowledge of irrigation. In return, the Southwest may contribute the experience gained from various experiments in human institutions and relationships, which, having proved successful among Spanish-American villagers in States along the border, may offer suggestions to countries farther south. Of course, many aspects of these experiments would need to be changed to be effective in the various countries, but surely those which have already stood a partial trial in a Latin American cultural setting and show signs of succeeding should be more worthy of trial than mere armchair ideas.

One of the most helpful of these experiments is a Health Cooperative Association which has been in progress since 1942 in Taos County in the northern part of New Mexico. Taos is one of the poorer counties of the United States. Over 95 percent of the people are Spanish-speaking villagers. As is true in many counties which are made up for the most part of small villages, the greatest need in Taos County is for health service. The infant mortality rate is exceedingly high. Two-thirds of all deaths were from unknown causes and many people died with no more medical attention than that of the local witch doctor. Hospitals were feared as places "where people go to die." Diets were poor. Even school lunch programs had little appreciable effect upon the performance of school children until village-wide parasite-elimination campaigns had been conducted.

The Earlier Taos County Project

The present Health Cooperative Association grew out of interest in an earlier health program developed among Farm Security Administration borrowers. This program was looked upon as desirable by a group of citizens known as the Taos Project group whose work was financed by the Carnegie Corporation. In 1936 the Harwood Foundation of Taos, providing a library, rare exhibits, pieces of Spanish colonial arts and crafts, an art gallery and auditorium, offices, special rooms and several apartments, was given to the University of New Mexico. In order to make possible the use of the Foundation for the welfare of all the people of the county the University solicited assistance from the Carnegie Corporation of New York. In 1938 the Corporation contributed $4,000 for a county-wide survey of Taos to determine the best use to which the Foundation could be put. The results of the study were published in a book entitled *Forgotten People*. On April 1, 1940, upon recommendation of the American Association for Adult Education, the Carnegie Corporation made to the Taos Project its second and last grant amounting to $43,000, with the stipulation that it must be used for a program of community and adult education in Taos county covering the years 1940 to 1943.

The spark plug of the Project was its county library and visual education service. A bookmobile, the first and only one in the State, carrying books and movie projector, equipped with screen, loud speakers, and microphone, reached most of the remote villages. It stopped at school houses, dance halls, homes, or other suitable buildings regularly. Branch libraries were established in 11 larger villages. To some communities books had to be carried by horseback during the winter months.

The results of the Project will go on and on in improved knowledge of soil conservation, irrigation, taxation and land division, woods, and improved livestock; in the establishment of school lunches and a program for the making and sale of handicrafts; and, perhaps most important of all, in the formation of a health cooperative association. Now that the Project has no support from outside, its bookmobile service is continuing through subscriptions by the local people of Taos County and the adjoining county, Rio Arriba.

The Taos County Cooperative Health Association

The Cooperative Health Association is closely associated with the rehabilitation program of the Farm Security Administration of the U. S. Department of Agriculture. In 1942, the doctors, dentists, priests, and other local leaders working with the leaders of the Taos County Project realized the need for a county-wide health cooperative organ-

ization. Eight hundred families made application for membership in such an organization, and several agencies and foundations were solicited for financial assistance. The Farm Security Administration investigated the enterprise and granted $47,000 for the year 1942. Each year thereafter similar grants have been made.

If a project of this kind is to be successful, it must be determined by the people themselves, and to enlist and incorporate into a working organization the people and agencies of the rural villages requires not only a great deal of time but careful management. The approach to the people is of necessity an informal one. In any Spanish-American community, even where bitter factions exist, everyone knows who the village leaders are and these leaders know the problems of each village family. In Taos County the storekeeper is frequently an important leader. To get the Project started, the Director of the Project and the Assistant Director, who was a Spanish-American, visited many hours with the appropriate leader, explained the Project to him, told him its objectives, and described the proposed organization and how it was to function. The interviews were always conducted in a leisurely manner. If the leader was a storekeeper, customers came and went. If the interview was well conducted, the local leader agreed that the Project might have advantages and be a good thing for his community. The interviewer then proposed that the leader call four or five of his close neighbors into his home that evening to let the field worker explain the program to them. After an hour or two of discussion the participants in this home meeting usually conceded that the proposed plan was a good one. It was then proposed that those present invite friends and neighbors to their homes on consecutively arranged nights to consider the matter. The Director then met informally with these groups.

Once the groundwork was laid by these informal home meetings, a community-wide meeting was called. At these general meetings, as in the previous conferences, the plan was described in Spanish. Some leader would move that the community join the program and send official representatives to the county staff. In many cases the villagers elected a staff of community officers and designated these officers to represent the community on the Project staff. Frequently the local school teacher became the secretary of the community organization and the Project's agent in the community.

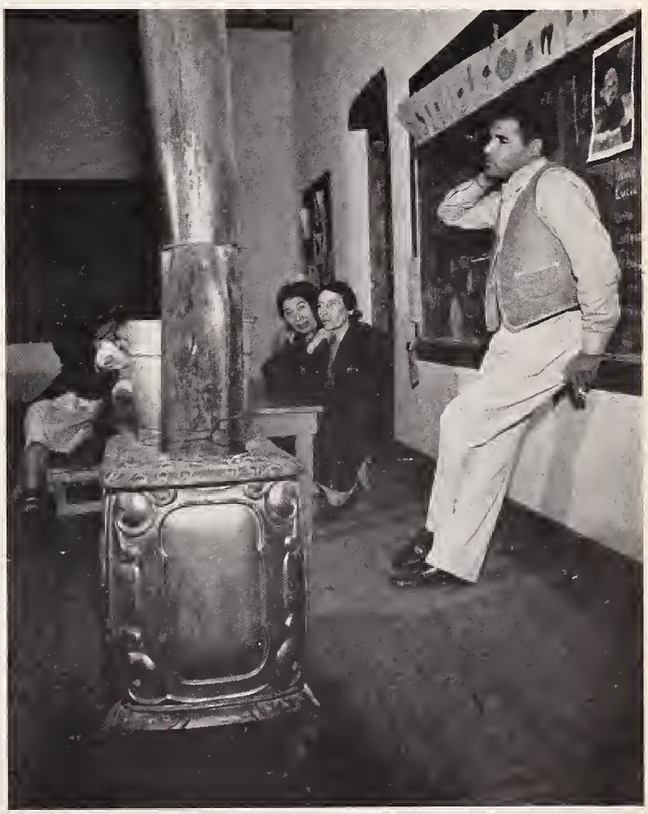
When the Taos County Cooperative Health Association actually started, some 1,145 member families, comprising 5,935 persons, or one-third of the county's population, were accepted as members. The membership is represented by a board of seven directors elected at the annual membership meeting of the Association. The Board of Directors, in turn, employs a treasurer-manager and an adminstrative staff.

In the past, members have borne about 15 percent of the total cost of operating the Association. Costs per family for medical, dental, and hospital service have amounted to about $40 per year. Membership charges were in proportion to the cash income, as determined by local committee and official action, and are calculated on a sliding scale so that the more well-to-do members pay relatively more for their services but never more than an established maximum charge. At first only families with cash incomes under $1,200 were admitted but now those with incomes under $1,800 are eligible for membership.

One must not assume that the mass of the villagers wanted to join the Association or to use all the facilities at first. Now that medical service within the reach of these people has become a reality, the problem has shifted from that of selling services to that of education of the people to use the services that they have bought. Members must learn to come for treatment in the early stages of illness, expectant mothers must be convinced of the value of prenatal care and advice, and the villagers must lose their fear of a hospital. This education will require years.

As a part of the program, interns from Mexico are being used with great success. A Puerto Rican nurse, under the close guidance of the supervisory nurse, has gradually taken over the direction of the nurses. However, the exclusive use of Spanish-speaking personnel is not necessary. Sympathy for the people on a high professional level, not mere

(Continued on page 95)



The Assistant Director of the Taos County Project lectures to a PTA group on the merits of school lunches.

The eternally snow-covered White Cordillera of the Callejón de Huaylas in Peru.

A Lost Village of the Andes

Nestled in the remote mountain valleys of Peru's towering Andes are little villages, known at one time by the Spaniards but long since forgotten by nearly everyone except the Indians.

by DOROTHY CHAPMAN

One of the most magnificent scenic regions of Peru is the Callejón de Huaylas, a narrow valley some 200 miles northeast of Lima. Its altitude is from 8,000 to 12,000 feet and, rising far above that height on either side, is a lofty range of mountains. To the west is a dark foreboding line known as the Black Cordillera; to the east, an eternally shimmering snow-covered range, the White Cordillera.

In 1943 I left Lima on a horseback trip into one of the more remote side valleys branching off eastward from the southern end of the Callejón de Huaylas. My destination was the little village of Popa, so cut off from the highways of travel that it has been almost forgotten. My car was left at 11,000 feet at the end of the road, where a guide was waiting with small mountain horses.

The trail led for some miles along the side of a mountain, with a deep broad valley at the bottom. Half way up the side of the opposite mountain, gleaming in the late afternoon sun, were the white walls, red tiles, and church steeples of a town of considerable size. With the surrounding patchwork of cultivated fields, it looked at that distance exactly like the miniature valleys of childhood toyland.

Dr. Chapman is Agriculturist, Office of Foreign Agricultural Relations. She has traveled extensively in Central and South America and lived in Peru for a number of years. All pictures were taken by the author.

A Hotel in the Valley

Our mountainside continued to be largely uninhabited until, just as darkness began to fall, almost directly below appeared a few lights. "*Ahora la escalera,*" said the guide with an airy wave of his hand. And the side of that mountain turned out to be almost literally a ladder. Generations of burros, horses, and Indians had worn rung-like declivities into the steeply sloping rocky walls of the only narrow ingress to the village from the mountain top. Cautiously but with a definite air of *savoir faire* my steed, about whom up to that moment I had not held too high an opinion because of an excessively rugged backbone, deposited us both safely at the bottom of the *escalera.* Many of the piled rock or adobe walls on either side of the road at the town's outskirts were topped with various species of Opuntia, or prickly pears. We splashed through the mud of the streets to THE hotel, rode through the opened, thick-beamed, tremendous door beneath the arched entrance and into the cobbled inner patio. A wall ran along one side of the patio, and the one-story hotel on the other three sides.

The Indian woman who owned it explained the rules of the establishment. All guests, regardless of gender, were commodiously provided for in one large room with seven beds tastefully arranged in two rows. A jug of water and towels were at one end of the room. All the other usually considered necessary elements of sanitation were completely lacking, either inside or outside. But the beds were clean and there were sheets.

Dinner was served in the tiny *comedor,* or dining room, which was dirt-floored and boasted two candle-lighted oilcloth-covered tables. One table was occupied by four Indian muleteers, complete in wool ponchos and with black hats set firmly upon their brows. I seated myself at the other. As has been the case invariably in every small hotel I have ever visited in Peru, the dinner was good. A delicious soup, liberally flavored with herbs and filled with chunks of vegetables and meat, came first. Rice and fried eggs made a satisfactory second course, and cheese, fresh rolls, and excellent coffee finished the meal. Dinner, it is true, was eaten with hats on and with a fork waved frequently in the air to underscore a statement, but the conversation was friendly and included all in the room. "*Buenas noches*" was said by all to everyone who entered, and the thoughtful "*Buen provecho*" (May the meal be of good profit to you) to all who left.

I turned in early. Although I distinctly identified one high and one low snore during moments of fitful slumber and remembered vaguely the stamp of boots and rattle of horses' gear in the early morning, when I awakened I found myself sole occupant of the room.

After breakfast we took to the trail again and followed it all day with but a brief stop for lunch. Down it went to 9,000 feet, wound for miles at that approximate level, and zigzagged up again. For hours the rocky mountain peaks above and rushing white torrent far below accompanied us. Except for the foot-wide ribbon of trail there was no sign that human beings had ever been there before. Occasionally parakeets darted out from beneath the horses' feet and were chased by my wildly excited cocker spaniel. One flock of nine long-tailed green parrots screamed shrilly at us as they streaked like a flight of arrows between the narrow rocky canyon walls. I was surprised to see them at 9,500 feet and more surprised to see huge masses of mistletoe, hung heavily with cream-brown berries.

The Little Indian Village

Late in the afternoon—apparently out of nowhere, for no other road entered the region—appeared the small Quechua Indian village of Popa. About half of the two or three dozen houses of the village had roofs of Spanish tile, most of the others had thatched roofs. A number of houses had two levels, with piled stones, or in one case simply a notched pole standing on end, the means of entrance to the top story.

Across the river from the village spread the buildings and fields of a small hacienda or *finca.* Although a complete stranger, I was welcomed here by the owners. Of Spanish descent, they had lived there for almost 30 years, and for generations before that the *finca* had been in Sra. B's family. The ancient one-story house, with thick white walls and red-tiled roof, was built around three sides of a patio. Here I stayed for several days, examining the agriculture of the little valley and photographing the town and its inhabitants.

The sierra region of Peru was the original home of the potato, and on this one farm grew twenty-four separate varieties. Most of them were smaller than the customary Irish potato of the United States, and many assumed the narrow elongated shape of the typical illustration of a rhizome in a Botany textbook. The color range of the inside was amazing. One, when ripe, was a vivid Kelly green;

Quechua Indian girls tilling a field near Popa.

An old church with its bell tower shows earlier Spanish influence in this little Indian village.

some were bright red; every shade of yellow and orange was represented; and one had concentric rings of purple and white with a star-shaped center. Several samples were boiled for me to try. They had a very pleasant nutty flavor but seemed of a different, more slippery consistency to the tongue than our potato.

Small beds of *oca* (*Oxalis tuberosa*), a wood sorrel having edible underground tubers, were being carefully tended by the Indians of the village. The *finca* had a dozen or so milk cows and a flock of chickens, and in front of several of the Indian houses I saw a pig or two tied by their hind legs to a stake. So the diet was more varied than in many parts of the country. Most of the Indians worked on the hacienda. The ground was first broken up by an ox pulling a wooden-pointed plow, or, in rocky soil, by men and boys with pickaxes. It was further pulverized by a row of girls across the field, each armed with a pointed metal bar fastened at a 45° angle to a short wooden handle, with which they struck the soil. I also saw these used as digging tools in harvesting plants.

Although the Spanish had in former times been in Popa, as was evidenced by a church with bell tower and a schoolhouse with a Moorish balcony, there was but little trace of them remaining in the inhabitants themselves. A few spoke Spanish, but the majority knew and used only the Quechua language. Even the youngest girls were never without a fluff of wool or cotton from which they drew thread as they sat or walked. The men and boys wore wool trousers, ponchos, and shapeless hats. The women appeared in the usual brilliantly colored, many-layered, hand-woven wool skirts, wool bodices, *mantas* over the shoulders, and white straw hats. Along the bottom of the full skirt was appliqued in cloth a delicate geometrical design in some contrasting color. Both men and women usually went barefoot or wore a leather sandal fastened by a thong between the large and first toe.

A completely unexpected sight at one side of the central square was a frame of two heavy logs with leg holes cut out—real old-fashioned stocks. As I had always associated such forms of punishment with our Pilgrim Fathers and the witches of Salem and vicinity, to picture it in these surroundings required considerable adjustment in thinking. Still in present day use upon rare occasions, no one in the village could remember how long those stocks had been there or from where they had come.

The flower garden at the *finca* was filled with luxuriantly blooming rosebushes, tree-like fuchsias, carnations, and geraniums. One section was devoted to herbs, which are used in cooking throughout most of Peru. I was told the virtues of each one, but that which I remember most clearly was a thin-leafed little plant which Sr. B. believed to have the power to heal wounds completely within two or three days. Sr. B. was an intelligent man, university-trained. He showed me a large ugly scar on his head where, when in his twenties, he had been kicked unconscious by a horse. Poultices of bruised leaves of this particular herb were immediately put on the deep bleeding wound, and, according to Sr. and Sra. B, tissue was formed over it in two days and it was completely healed in less than a week.

The days went by quickly and all too soon I found myself on the trail again. Warm memories still linger, however, of the hospitality and charm of the forgotten village of Popa in the Peruvian Andes.

The writer was surprised to find old-fashioned stocks in a South American Indian village.

BRAZILIAN COFFEE

(Continued from page 85)

A coffee cherry is composed of two beans, each of which if planted might produce a coffee tree. A layer of shell is around each bean, and one thin and one heavy layer enclose both beans. When the cherries are thoroughly dried these shells can be easily broken and removed by a beating process in the mill.

Milling equipment is a series of beaters, blowers, and sieves to remove the outer coatings of the cherry. Practically everything is removed except the mature bean, which is so tough that it is not affected by the beating. The shelled bean is dark green in color if it has been properly dried, and this color, rather than an unripe state, is the origin of the term green-coffee trade. In the milling equipment the beans are sorted by size and amount of trash and are sacked in "up-country" bags.

Marketing

Large growers process their own coffee; small growers sell theirs soon after it is dried and the buyers process it. Sometimes growers do not need to sell their coffee at once. They may hold it from 5 to 8 years without seriously affecting its quality, although after a year or two the color becomes lighter. If it is held in storage too many years, some of the flavor is lost. On the other hand harsh coffees lose some of their harshness.

Most up-country producers sell their coffee through commission men or brokers, who sell to exporters in some port such as Santos, the largest coffee port in the world. These exporters, in turn, sell to importers in the United States or other foreign countries. Of the 45 exporting firms in Santos, 4 of the 5 largest are United States firms. Eight of the firms handle more than half of all coffee exported from Brazil.

Coffees received from up-country are mixed to meet the importer's requirements. Rarely are shipments made of straight farm-quality coffee. There are more grades of coffee than there are qualities of cotton. Quality is determined by taste, color, smell, size and shape of bean, amount of trash, and number of imperfect beans in the sample.

Taste is probably the most difficult quality to determine because it depends upon the judgment of the individual taster. Taste is determined by "drinking." The coffee beans are roasted to a chocolate brown color, ground coarsely, and an amount sufficient to balance a nickel, a dime, and a quarter on small scales is put in a large cup and covered with hot water. As soon as it is cool, the taster sucks with a loud noise about a tablespoonful of the liquid coffee. The suction has such force that the taster's palate is sprayed with liquid coffee. As soon as the taster decides upon the quality, he spits out the liquid. Tasters grade from 600 to 3,000 cups a day.

By taste, coffee is graded into about six main grades, with finer distinctions when the foreign importer is difficult to please. From better to poorer, the grades are: strictly soft, soft, softish, hard, free from Rio flavor, and Rio flavor. Most coffee shipped from Santos is of the first three qualities, while the latter three come principally from Rio de Janeiro and Victoria.

After the coffee is mixed, it is put in special export bags which have a strip of green and yellow thread, the national colors, running the length of the bag. A map of Brazil and the words "Brazilian Coffee" are stamped on the bag. Each bag holds 60 kilos or about 132 pounds.

Brazil exported over 13 million bags of coffee in 1944, according to the Bulletin published by the National Coffee Department. This was the largest amount exported since the pre-war year of 1939. By far the greater part of this coffee went to the United States either for civilian consumption or for the Armed Forces. In 1943 coffee represented over 55 percent of the value of all exports from Brazil.

HEMISPHERIC SOLIDARITY

(Continued from page 91)

facility in language, is the basis for that confidence of the patient in the professional workers which is so important. The supervisory nurse with training in social psychology, sociology, and psychiatry is able to show the doctors and nurses the necessity for making their practices acceptable to the people through an understanding of the witch doctor's appeal and the superstitions of the people. When possible, patients who are timid are permitted to bring relatives with them to hospitals. Effort is made to make them feel at home by allowing them to retain symbols of sacredness. In the well-baby and prenatal clinic intimacy and privacy are striven for. In short, medical practice is so oriented as to inspire confidence on the part of Latin Americans who have not known or had confidence in professional doctors.

In spite of the fact that the Taos County Cooperative Health Association is a relatively recent experiment, that mistakes have been made, and that high wartime mobility of both people and professional personnel has been detrimental to its most effective operation, the author believes that the health of the people of Taos County is better because of its existence. Outmoded medical practices are being supplanted by modern professional services. Isolated rural villages now have medical services, whereas formerly only the few more well-to-do could afford to pay for the visit of a private doctor. The experiment, with its clinics and visiting nurses in the outlying villages, coordinated with the public health program of the State, may offer suggestions for similar communities and in this way make its contribution to hemispheric solidarity.

ALONG THE *Agricultural Front*

▲ Third Inter-American Conference on Agriculture

The third Inter-American Conference on Agriculture will be held at Caracas, Venezuela, on July 24, 1945, for a period of approximately 2 weeks. The primary objective of the Conference discussions will be to survey the problems affecting agriculture in the post-war period. The agenda for the Conference was approved by the Governing Board of the Pan American Union on February 7, 1945.

The second meeting of the Inter-American Conference on Agriculture was held at Chapultepec Castle, Mexico City, in 1942, meeting place of the recent Inter-American Conference on Problems of War and Peace. The first Inter-American Conference on Agriculture met at the Pan-American Union, Washington, D. C., in 1930.

Discussion this year will be directly concerned with agriculture and the post-war agricultural economy. It will include talks on commodities important to world trade, both as to present and future prospects for various crops such as cotton, wheat, sugar, and coffee, and on plans to promote orderly production and distribution of surplus commodities through international agreements. Other major topics to be discussed will include a review of the recommendations of the United Nations Monetary and Financial Conference at Bretton Woods; methods for increasing efficiency of production and consumption of raw materials to provide a higher standard of living in every country; agricultural credit; air transportation of agricultural products; development of services for marketing and distribution of agricultural products; and agricultural migration problems.

An Organizing Committee, headed by Dr. Angel Biaggini, Minister of Agriculture of Venezuela, is responsible for Conference arrangements. This group will select the meeting site, assemble motion pictures, issue releases, collect exhibit material, and provide a special library for use of delegates during the Conference. A series of technical bulletins are being prepared by Venezuelan authorities on agriculture and animal husbandry. At the request of the Organizing Committee, the U. S. Department of Agriculture is cooperating in preparation of documentary material as well as a bulletin of information on agriculture in the United States for use of delegates. This bulletin will be available for public distribution in Latin America after the Conference. In addition, special exhibit material will be shown.

▲ Chilean Farmers Aided by Observatory

The El Salto Observatory of Chile, which recently celebrated the twenty-fifth anniversary of its establishment, has an unusually active meteorological section that has, by means of publications and scientific education, greatly stimulated agricultural production. Publications that have been of especial assistance to farmers are: *New Methods of Forecasting Weather for Agriculture Which Are in Use in the United States, The Various Methods Applied to the Study of the Weather, Reports on the Weather for Agriculture, Instructions for Observing the Barometer and the Clouds,* and *Pictures of Clouds.* Copies of these publications have been sent to thousands of Chilean farmers.

▲ Panama's National Fair Postponed Until 1946

Plans for the annual National Agricultural Fair, which was to have been held in David, Chiriqui Province, Panama, have been postponed until 1946 in order to permit the completion of new buildings. The new buildings will be erected on the former site of the David race track, including various exhibition pavilions for general displays of products and for the different Provinces of the Republic. A grandstand and track for judging animals are under construction, and provision will be made for industrial as well as agricultural displays. The 1946 fair promises to be representative of Panama's agricultural progress.

▲ Cotton Advisory Committee Meets in Washington

The International Cotton Advisory Committee, established in 1939 to study and report on problems in the world's cotton industry, held its fourth meeting in April in Washington. Countries represented at the meeting were Brazil, Peru, Mexico, Egypt, India, Turkey, the Union of Soviet Socialists Republics, British and French cotton-exporting colonies, and the United States.

When the Committee met, it found there is a definite world problem of surplus stock and production. The Committee agreed that it is preferable to solve this problem through international collaboration rather than through any form of unilateral action by exporting countries in disposing of surplus supplies. As this issue of *Agriculture in the Americas* goes to press, deliberations are continuing.

The meeting was presided over by Leslie A. Wheeler, Director of the Office of Foreign Agricultural Relations, U. S. Department of Agriculture. Other delegates from the United States included E. S. Mason, Department of State; C. C. Smith, Commodity Credit Corporation; C. D. Walker, Agricultural Adjustment Agency.

▲ Cuba Works For Improvement of Cattle

The Cuban Government is taking an active interest in the improvement of the cattle industry in Cuba. The Ministry of Agriculture has established an animal industries section within its Division of Industries, charged with promotion of cattle production. Future plans will be influenced by the results of the livestock census now in progress. Plans have been announced for government sponsorship of the importation of breeding animals. The prohibition on the commercial slaughter of bulls, originally established in 1936 but suspended in July 1944 when beef was scarce, will be re-established on July 1, 1945. This ban is placed in order to promote the production of good beef steers and to increase production of tallow as a means of relieving partially the shortage of fats and oils.

▲ Chile Has New Storage Elevators

Near Yungay station in Santiago the Institute of Agricultural Economy has constructed storage elevators with a capacity of approximately 735,000 bushels of loose wheat and 110,230 bushels of bagged wheat. When all the transportation equipment is installed, more than 4,400 bushels of wheat can be received per hour, representing 30 freight cars of 30 tons each per working day. There are 4 fumigation chambers, each with a capacity of 30 tons of wheat. Power for the elevators will be furnished by the city's electric light and power company. Construction of the new elevators was begun in September 1941 and they were inaugurated last August.

PARAGUAY RIVER BASIN

(Continued from back cover)

sharply with the land of rich vegetation in the Amazonian belt. To the south of the divide whence these streams originate there is a grazing area of broken, rolling plains. These plains reach down into northern Paraguay's cattle ranges, though here and there throughout the area are clumps of forest where yerba mate, known as Paraguayan tea, is grown. The upper Paraguay River spreads out during the rainy season over a considerable area of grasslands, but when its waters recede, there is good pasturage for a large number of cattle. The land which is swampy during the wet season in this general region is confined mainly to the eastern side and a narrow margin west of the river.

In the land west of the Paraguay River one sees the typical Chaco vegetation and topography. This consists of flat prairie land. During rainy seasons the almost impermeable surface of this open savannah is covered with water. Part of the Chaco, however, is swampy forest jungle, replete with jaguars, ant-eating bears, poisonous reptiles, stinging insects, and alligators. Though not without some possibilities for future development, it is not the sort of land in which men build the home of their dreams. Hence, it is one of the sparsely settled areas of Latin America.

In direct contrast to this is that part of Paraguay lying east of the river. Here one sees rolling land with some marshes, some upland tropical forests, considerable good open farming country of the *tierra colorada,* or red earth, type and low mountains, extending at one point south of Asunción to within about 50 miles of the river. It is in this land to the east of the river that the major part of Paraguay's people live and here most of the country's crops are grown.

The People

Most of the people living in the Basin are of a well-integrated *mestizo* type, a blend of the original Tupí-Guaraní Indians and the early Spanish settlers. There are few pure Indians or pure whites, though some Europeans came to the country within the last 75 years and their descendants may still be found there.

In most countries of Latin America the aboriginal tongues are usually spoken only by pure Indian groups. Along the Paraguay River, however, Guaraní is almost universally used, even by those people who claim little or no Indian ancestry.

Agriculture of the Basin

The Paraguay River and its tributaries drain an area that is rich in a variety of agricultural and forest products. As one goes up the river, to the accompaniment of screeches from the brilliant-hued parrots inhabiting the dense tropical growth on the shore, he sees many boats of different types and sizes, from steamers to small vessels, piled high with varied products. There are bales of yerba mate leaves, a product which is made into a stimulating drink used by 15,000,000 people daily in Paraguay, Chile, and Argentina. There are boats loaded with meat, hides, and skins; with quebracho, which is valuable not only as one of the world's strongest timbers but as a source of over 32,000 tons of tanning extract yearly; with cotton, coffee, tobacco, sugar, castor beans, petit-grain oil, and sweet wild oranges.

The agricultural potentialities of the Basin are great. An estimated 75,000 acres on the eastern side of the Paraguay are adaptable to cotton growing alone. Though much of this land has not yet been developed, the soil is so good that yields of from 250 to 470 pounds of ginned cotton to the acre have been reported. Sugarcane grows almost anywhere in the region. Yerba mate covers an area of 25,000 to 30,000 acres in northeastern Paraguay.

Life in the Basin

Generally speaking, the climate of the region is benign. The average monthly temperatures at Asunción, the capital of Paraguay, range from 62° to 80° F., not unlike those at Miami, Florida.

Asunción is a curious mixture of the primitive and the modern. Burros still carry loads over cobblestone streets from the interior to the market and to the waterfront. Yet there are sawmills, a sugar refinery, and flour mills. From the hills back of the town one may see steamers plying up and down the Paraguay River a thousand miles from the sea.

Going northward from Asunción about 125 miles, one reaches Concepción, Paraguay's second-most-important commercial center, an outlet for yerba mate and cattle products. Commerce between Concepción and the cities of Argentina and even with European centers goes on regularly in normal times. Still farther up the Paraguay River is Corumbá, in the State of Mato Grosso, Brazil, near the Bolivian border, where the custom house collects around $620,000 each year. Yerba mate, cattle, beef, hides, and rubber are shipped out of this port. Then there is Cuyabá, the capital of Mato Grosso State. Originally a mining town, it is now a fairly prosperous commercial center, which some day may be connected by an 840-mile railway with Rio de Janeiro, the capital of Brazil. Meanwhile, communication between the two capitals is only by air or by the circuitous 3,700-mile trip via the Cuyabá-Paraguay-Paraná-La Plata River system and the Atlantic Ocean.

Looking to the Future

The tributaries of the Paraguay River system are not dotted with commercial centers. There are, however, economic prognosticators who have ventured to foretell possibilities for the regions along the Pilcomayo and Bermejo Rivers, provided certain improvements could be undertaken. There are some who look forward to the discovery of oil in the Gran Chaco, and a consequent transformation of that region. In the meantime, more practical planners are engaged in developing the resources that are known to actually exist. These resources, they believe, constitute in themselves sufficient hope for the region's economic future.

South America Called Them, by Victor Wolfgang von Hagen. 311 pp., illus. Alfred A. Knopf, New York, 1945. This is the story, not of conquistadors, but of four young scientists who made separate explorations in South America covering nearly a century and a half from 1735 to 1864. The personal experiences of these scientists and the discoveries which they made are told by a naturalist who himself has explored much of the same territory.

Part I contains the story of Charles-Marie de la Condamine, sent by the French Academy of Sciences to ascertain the true shape of the earth at the Equator. The place chosen to begin measurements of angles and triangulations was Quito. For 9 years he traveled over Ecuador and Peru and down the length of the Amazon to the Atlantic.

Part II recounts the expedition of Baron Alexander von Humboldt to the guano-covered islands off the coast of Peru and up the Orinoco River to its source to learn whether that body of water made contact with the Rio Negro and so with the Amazon.

Part III is the account of Charles Robert Darwin's travels as companion naturalist with the captain of H.M.S. *Beagle* down the west coast of South America, including the famous visit to the Galápagos Islands, around Cape Horn, and up the east coast.

Part IV is the story of Richard Spruce, professional botanist, who traveled up the Amazon. It contains the story of the beginning of the rubber boom and the search for the seeds of the quinine.

Basic Data on the Other American Republics. 172 pp. Office of the Coordinator of Inter-American Affairs, Washington, D. C., 1945. Covers political background, organization, major dates, administration, land, people, education, transportation facilities, level of living, labor, agriculture, manufacturing, trade, foreign exchange, investment, finance, current economic problems, economic relations with the United States, and contribution to the war effort of each Latin American country, almost in outline form. Gives a table of basic facts at the end.

Conferencias internacionales americanas, primer suplemento, 1938-42, by the Division of International Law of the Carnegie Endowment for International Peace. 501 pp. Carnegie Endowment for International Peace, Washington, D. C.; 1943. This book contains the conventions, declarations, recommendations, resolutions, and motions adopted at the 8th International Conference of American States, the first three consultative meetings of Foreign Ministers, and other data relating to inter-American commissions.

A Selected List of Recent United States Government Publications, compiled by Violet Abbott Cabeen for the Books for Latin America Project of the American Library Association, 93 pp. American Library Association, Chicago, Illinois; 1944. A selection of items, including those on Latin American affairs, published from January 1943 through April 1944. It is distributed to libraries listed as repositories for Federal documents.

Latin America in the Future World, by George Soule, David Efron, and Norman T. Ness. 372 pp., illus. Farrar and Rinehart, New York, 1945. Describes and analyzes basic problems, such as purchasing power, nutrition, housing and sanitation; shows how war has caused economic dislocation and given birth to programs for betterment; and puts forth a series of recommendations for further improvement.

Para resolver los problemas de América y del mundo, by Alberto Sayán de Vidaurre. 371 pp. Librería y Editorial "El Ateneo," Buenos Aires, Argentina, 1944. Pictures the part which the Americas can play in the post-war world based on an economy of abundance. Makes several proposals concerning the author's ideal organization of inter-American activities. Discusses social and political democracy and has a special section on relations between Argentina and the United States.

Estados Unidos de América, centro de democracia mundial, by Alberto Sayán de Vidaurre. 219 pp. Editorial Argentina Arístides Quillet, S. A., Buenos Aires, 1944. A pro-United States book written by an Argentinean. Deals with Pan Americanism and other "isms" in the American Hemisphere, President Roosevelt, Henry A. Wallace, Nelson A. Rockefeller, and Sumner Welles. Has a prologue by Dr. Ernesto Nelson, President of the Argentine-North American Cultural Institute, and an epilogue by former U. S. Ambassador to Argentina, Norman Armour.

Editor's Note.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

AGRICULTURE IN THE AMERICAS — O. R. CARRINGTON, EDITOR

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Gifts of the Americas

CANDELILLA WAX*

by BEATRICE DU FRANE

Growing in a desert-like area where the annual rainfall may be less than 4 inches, the candelilla shrub produces its valuable wax under growing conditions so severe that most plants could not survive. Native to northeastern Mexico, the plant is found in the arid semi-desert regions of that country.

Candelilla wax finds its way into explosives, carbon paper, wax matches, ointments, plasters, and phonograph records. Combined with rubber and gutta-percha it serves in the manufacture of insulators and electrical apparatus. It may be mixed with other waxes and made into candles, or with fats and other waxes and made into furniture polish. Combined with chicle and other gums, it may be utilized for chewing gum. Candelilla wax is also employed to a limited extent in the manufacture of wax figures and waterproofed objects. In Mexico the wax is used by the tanning industry to finish certain hides.

Botanically candelilla is known as *Euphorbia antisyphilitica* Zucc. and belongs to the family of Euphorbiaceae. It is a low-growing perennial plant. Because of the growth of small white hairs, the tiny leaves, which are brownish red on young stems, become somewhat ashen in appearance when the stems mature, and soon drop off. The small stalked fruit appears from May to July, and natural seeding is aided during this period by the early summer rains. Most of the wax is found in a thin film on the stems, giving them a whitish appearance. In addition, wax forms in the plant's outer cells and exudes from certain pores. In the winter, when the water content of the plant is reduced, the amount of wax increases, and this serves to conserve the moisture.

Usually the candelilla is found on soil that is sandy and lacking in humus, although it will grow on other soils. Because the seeds are rare and hard to gather and the plant grows in arid regions where man does not live easily, propagation must depend largely upon natural seed germination rather than artificial cultivation.

Wild plants have been harvested since the beginning of the twentieth century. It is from these natural stands that the wax is still obtained. Although carried on irregularly throughout the year, the harvest takes place mainly during the winter. At that time seasonal unemployment makes labor available and the plant's supply of wax is at its height. When harvesting is done in the winter, the roots left in the ground after the plant has been pulled may be injured by the cold so that they fail to put out new shoots. In this way stands of candelilla may become exhausted, but, if the fields are allowed a partial rest every 3 or 4 years, a stand will continue to produce from 12 to 16 years.

Wax extracted during the winter, as a rule, has a higher melting point than that collected during the summer. The wax content of the plant ranges from 1 to 6 percent, with a high resin content. Soil and climate also influence wax content. Along the coastal areas the combination of heat and undue moisture results in a low yield of wax. In dry areas the yield is greatest.

Harvesting of candelilla is carried on, for the most part, by three methods: crop sharing, leasing, and direct exploitation by landowners. Crop sharing is perhaps the most common. Under this arrangement, the crop sharer is entitled to a varying percent of the value of the harvest. Leasing arrangements provide for a definite rental, the lessee being entitled to all other profits. The third method is carried on by small individual landowners or by *ejidos* (a number of farmers owning land in common). These communal owners harvest the candelilla on a cooperative basis. Following deductions for cash or other loans and for operating expenses, each member is paid on the basis of his individual output.

The wax may be extracted by the use of solvents or by boiling. This raw wax is white; the refined product is the color of *café au lait*. Only about 50 percent of the plant's wax is obtained by these methods of extraction and about 50 tons of raw material are required to produce 1 ton of wax. Lightweight extraction equipment is used because it must be moved from one area to another as the supplies of candelilla plants are exhausted.

The extracted wax is sold to large trading companies which refine it still further. The finished product is broken into small pieces and placed in sacks for shipment. Much of the wax is exported to the United States, shipments coming in mainly by way of Tampico or Laredo. The United States has been a constant buyer since the turn of the present century.

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* Most of the material in the article was obtained from the *Monthly Bulletin of Agricultural Science and Practice*, March and April 1939, International Institute of Agriculture, Rome, Italy.

THE PARAGUAY RIVER BASIN

by **Philip Leonard Green**

In the native Guaraní language, spoken throughout Paraguay by virtually all the people, the word *paraguari,* from which the name Paraguay is derived, means "a place with a wide river."

To Paraguay, a country with no sea coast, whose nearest boundary is nearly 400 miles from the ocean, the river which bears the same name has been more than just one more river. As the country's main artery leading to the outside world, the Paraguay River has been nothing short of a national life line. On it steamers go the full length of the country, and through its river ports are shipped the products not only of Paraguay but of parts of Bolivia and Brazil which could hardly be reached as economically in any other way as by this great river and the rivers that flow into it.

The River and Its Tributaries

The river rises in a cluster of intermittent feeder streams in southwestern Brazil. Not until it reaches Barra dos Bugres does the Paraguay become a steady stream. It then flows in a southerly direction, for the most part near the Bolivia-Brazil frontier, actually constituting the boundary between these two countries for a short distance before first touching Paraguay at Confluencia, where Bolivia, Brazil, and Paraguay meet.

It then pursues its southward journey through Paraguayan territory, until it reaches Asunción, capital and chief port of Paraguay. From this point, as far south as Tres Bocas, the territory west of the river is Argentina, while that on the east is still Paraguay. Tres Bocas marks the southern boundary of Paraguay and at this point the river joins the Paraná and loses its identity as the Paraguay River. From there the Paraná continues southward through Argentina nearly 700 miles to where it broadens out into what is known as the La Plata, which in turn flows into the Atlantic Ocean. Buenos Aires is located on the La Plata.

The Paraguay River as it flows through Paraguay itself is about a quarter of a mile wide, on the average. Its western shore, where the Chaco begins, is low, but on the eastern shore there are fairly long stretches where the banks are relatively high. The river is navigable for vessels of 6- or 7-foot draft as far north as Corumbá in Brazil, which is about 1,800 miles from Buenos Aires. Regular service is maintained to Corumbá. Vessels of 5-foot draft go 200 miles farther, to Cuyabá, Brazil, on the Cuyabá River, a branch of the Paraguay.

Some of the tributaries of the Paraguay, such as the Apa and the Aquidabán, which come into it above Concepción, are too short and swift-flowing, generally speaking, for navigation. Others, like the Pilcomayo, which comes in from the west almost opposite Asunción, and the Bermejo, largely in Argentina, which flows into the Paraguay near Pilar, are too sluggish and rambling. Both of these western tributaries reach into the Andes Mountains of Bolivia but flow through largely uninhabited regions. In fact, full exploration of the Pilcomayo has never been made.

On the other hand, large steam launches may be seen on the Ypané, which flows into the Paraguay from the east near Concepción, the Jejui-Guaxú coming in south of San Pedro, and the Tebicuary in southern Paraguay between Formosa and Pilar. On the numerous small branches of these rivers flat-bottomed boats called *chatas* bring out the yerba mate and other products of the interior regions.

Land Drained by the River

The land around the headwaters of the Paraguay is typical of the bush country that extends across the Mato Grosso region of Brazil. It contrasts

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NAMES & NEWS

Visitor From Mexico

Sr. Vicente Nájera, Mexican industrial leader, recently visited this country to confer with agricultural officials in Washington and at Beltsville on the value of fish meal as chicken feed.

●

Receives Assignment to Nicaraguan Station

Virgil C. Pettit, Agricultural Engineer, Office of Foreign Agricultural Relations, has been assigned to the Cooperative Agricultural Experiment Station in Nicaragua. He will direct agricultural engineering and construction work there and will also assist with the same type of work at the Cooperative Agricultural Experiment Stations in Guatemala and El Salvador.

●

Visitor From Brazil

Dr. Jose H. Bastos de Oliveira, Professor of Agronomy and Agriculture in the State College of Agriculture, Ceará, Brazil, has returned to his country after spending a year in special study in the United States under the supervision of the U. S. Department of Agriculture. Dr. Bastos visited a number of universities and colleges and this spring spent considerable time in conferences in Washington and at Beltsville Research Center.

●

Cuban Visits United States

Ing. Manuel San Martin, Assistant Director of the Cuban Office of Price Regulation and Supply, and Adviser to the Cuban Sugar Mission, came to Washington this spring to confer with representatives of the U. S. Department of Agriculture on problems relative to the production of kudzu grass and Virginia jumbo peanuts and on methods for increasing milk production in his country.

Brazilian to Study Here

Dr. Otto Lyra Schrader, Assistant Director of the Federal Experiment Station in Brazil, recently came to this country to investigate methods of agricultural research, soil conservation, and operation of Federal and State experiment stations. He will spend a year in the United States. Upon returning to Brazil he will assist with agricultural research and serve as liaison for trainees from that country who have studied here.

●

Argentine Chemist Receives University Scholarship

Dr. Raul J. Hermitte, Argentine biochemist, has been awarded a scholarship for study at the Experiment Station of the University of Colorado. Dr. Hermitte will specialize in a study of the sugar industry and its byproducts.

●

Working With Mexican Guayule

At the request of the Continental-Mexican Rubber Company, *Dr. Aubrey Clare Hildreth*, of the Bureau of Plant Industry, and *Paul H. Roberts*, Director of the Emergency Rubber Project, U. S. Forest Service, have gone to Mexico to assist with the work being carried on in the production of guayule and guayule rubber.

●

Goes to Guatemala

Edson J. Hambleton, Entomologist, Office of Foreign Agricultural Relations, left recently for Guatemala, where he will spend 3 months assisting with the establishment of an entomological program for the *Instituto Agropequaria Nacional*.

●

Returns to Mexico

Dr. Weston J. Martin, who has been in Washington for several months consulting with officials and making arrangements for publishing the results of certain phases of the over-all rubber program in Mexico, recently returned to that country, where he is in charge of disease investigations at the El Palmar Rubber Experiment Station.

Agriculture IN THE *Americas*

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Latin American Tobacco Yesterday and Today

Few people realize that tobacco was grown and used in the Americas long before the Europeans came here. At one time the Spanish colonies supplied the world with leaf tobacco, and today Latin America contributes substantially to the world's supply.

by LOUISE MOORE COLEMAN

Our present knowledge of tobacco dips only slightly into pre-Columbian times but those days intrigue the imagination. Excavations from the time-buried cities of Mexico, Central America, and the Andean plateau tell stories of civilizations ante-dating by hundreds of years those found by the Spanish conquistadors.

Evidences of the use of tobacco by these early Americans have been frequent among archeological findings. Pipes believed to be 2,000 years or more old have been excavated. Thousands of primitive cigarettes have been found in the old shrine-caves of Arizona. Bas-reliefs from sunken temples of the ancient Maya Indians show mothers smoking while nursing their babies, mute but indisputable evidence of tobacco's remote yesterday.

Tobacco has been satisfactorily established as one of the original American plants. Approximately 20 percent of all the known species have been found growing wild or in aboriginal cultivation in the Americas. To the Indians it was their gift from the Great Spirit, and they used it as a medicine, to relieve fatigue, and in their religious rites.

Early Users of Tobacco

The Mayas are the oldest Indian stock of whom we have knowledge. According to tradition, they emigrated from "the far north" to Mexico and Central America sometime before the beginning of the Christian Era. By 600 A.D. they had built cities, among which were Palenque in Chiapas, in the southeastern part of Mexico, Chichen Itza, Uxmal, and Mayapan in Yucatán, Quirigua in Guatemala, and Copan in Honduras. Then came the Spaniards. Now only the ruins of temples and shrines mark the dwelling place of the Mayas, with their sculptures and bas-reliefs to tell us of their way of life. Since the Mayas raised and used tobacco commonly, the original consumers must have gone back even further.

The Aztecs entered America in great numbers from the northwest during the eleventh or twelfth century. They made rapid strides in the ways of civilization, and the records of the Spanish conquistadors reflect Aztec culture at its highest. Agriculture among them was in an advanced state. They practiced irrigation and terrace farming, built granaries for their produce, fallowed their land, and penalized the extravagant use of forests. Tobacco was one of their crops. It was carefully cultivated and meticulous care was given to harvesting and curing the leaves, which they prepared for various uses.

Louise Moore Coleman is Associate Economist in the Office of Foreign Agricultural Relations. She has been associated with the U. S. Department of Agriculture for many years and is the author of a number of articles and publications on tobacco production, consumption, and trade in foreign countries.

Tobacco occupied an important place in the Aztec daily life, which among the nobility was spent in comparative luxury. Both nobility and commoners smoked after dinner to prepare for the siesta which was observed punctiliously. Tobacco was always present at the banquets of an Aztec emperor. Guests were presented with flowers as they arrived and with finger bowls and cotton napkins as they sat down for the meal. Tobacco was then offered them, either in pipes, mixed with aromatic substances, or in the form of cigars inserted in holders of tortoise shell or silver. Such was the triumphant yesterday of tobacco among Mexico's Aztec Indians prior to the Spanish Conquest.

The Incas settled in the Valley of Cuzco about 400 years before the Spanish Conquest and built an empire stretching 2,700 miles from the region of Quito in Ecuador to the south-central part of modern Chile. Their use of tobacco was medicinal and mystic, bordering on religious fervor. They smoked the leaf and snuffed tobacco powder for various ailments and spread the leaves on the ground while they slept, to keep snakes away. Tobacco was their talisman in time of peril and their burnt offering to appease the wrath of the gods in calamity. It was not used for pleasure or to relieve fatigue, probably because they had a substitute in the leaves of the coca plant, the use of which prevails among Peruvian Indians even today. Coca should not be confused with cocoa or cacao, the nut from which chocolate is made, nor with coco, the coconut. The coca plant is *Erythroxylon peruvianum,* a non-intoxicating stimulant occupying a place in the daily life of the Andean countries similar to that of tobacco in other parts of the world.

The Chibchas were a group of South American Indians occupying the high valleys in the vicinity of Bogotá and Tunja in Colombia and extending out in influence into Central America and Venezuela on the north and into Ecuador on the south. When the Spaniards entered their territory during the first half of the sixteenth century, these natives of Colombia were producing a strong tobacco which they consumed in a sort of secondary fashion. Those wishing to smoke sat in a circle around a small boy holding a cigar 2 feet long. He did the smoking and puffed the smoke into the faces of those around him, in order that they might inhale it. The records do not state whether the same boy ever performed this ceremony twice. In Venezuela the natives, many of whom were Chibchas, were making great use of tobacco. They smoked excessively, especially after their meals, and partook of snuff. Their best tobacco grew along the Orinoco River, and much of the tobacco leaf in present-day commerce has been obtained by skillfully crossing and re-crossing the Orinoco variety with others.

Thirty-day-old tobacco seedbed in the semi-Vuelta zone of Cuba.

Bamboo racks are used for sun-curing tobacco in Ecuador.

Spanish Domination of Tobacco Market

When the Spaniards began the cultivation of tobacco in their conquered territory during the first half of the sixteenth century, they selected seed from Mexico, Central America, Colombia, Venezuela, the Guianas, and Brazil, the territory occupied in earlier times by the Mayas, Aztecs, Incas, and Chibchas. That aboriginal tobacco is said to be *Nicotiana tabacum,* one of the best and most widely known species, representing the greater part of the world trade in tobacco today.

The only tobacco on European markets for nearly a century after the Conquest came from the Spanish American colonies of Trinidad, Venezuela, Colombia, Cuba, Brazil, and others. This Spanish domination of the market, coupled with the frequent wars between Spain and England, led to some interesting economic repercussions. Near the close of the sixteenth century, for instance, prices of Spanish American tobacco in England began to soar, averaging about 30 shillings a pound. Smoking at this time was growing more and more popular in Europe and demand was at its highest. Two things happened: Very small pipes became fashionable in England, and the British began to grow tobacco in Virginia.

Latin American Tobacco Today

Many changes have taken place in the Latin American tobacco industry since the period when Spanish colonies were supplying the world with leaf tobacco. Production has spread to practically all parts of the world. Production and trade centers have shifted, and consumption of tobacco has increased to unbelievable proportions.

Latin America, the oldest tobacco-producing region, contributes today about 7 percent of the world's leaf supply. Brazil, whose annual crop averages over 200 million pounds, is one of the five largest producers of the world. The Cuban crop, in great demand for cigar output, averages about 50 million pounds, and the production of all Latin America is a little more than 421 million, as compared with a world crop of nearly 6 billion pounds.

Only a few Latin American countries—Brazil, Cuba, Colombia, Paraguay, and Dominican Republic — ordinarily have an exportable tobacco surplus. With the exception of Cuba, which markets from 50 to 75 percent of its surplus in the United States, Latin American tobaccos are exported principally to Europe, as in the early days. Germany and the Netherlands were the largest European prewar buyers.

Brazil's Tobacco Trade

The large leaf crop of Brazil is outstanding among those of other Latin American countries. Tobacco is grown in every State, but the industry is greatest in Baía, Rio Grande do Sul, Minas Gerais, and Santa Catarina. Brazilian types are either descendants from imported varieties that have degenerated through cross pollination, or from Brazil-Bahía, the dominant domestic type. Bahía tobaccos are the dark air-cured types used in the local cigar industry and normally exported to Europe in large quantities.

Light types have been developed in Rio Grande do Sul and Santa Catarina with seed imported from the United States. When air cured, they produce tobaccos similar to Burley, but during the past 20 years the introduction of flue curing, together with new methods of planting and fertilizing, has created a product similar in appearance to American flue-cured. These Brazilian flue-cured tobaccos are blended with domestic types or with Turkish and used in the manufacture of cigarettes.

Minas Gerais produces dark air-cured types, used largely in the manufacture of rope tobacco, which is an industry unique unto itself. In making rope tobacco, large, thick, partially cured leaf-strips are lapped, twisted into a cord, and wound on a windlass stick about a yard in length. After drying a few days, the coil is dipped into tobacco extract to which sweetening and flavoring materials have been added. It is then twisted much tighter and wound again on the windlass. This operation is repeated several times, the rolls having been dried in the sun each time for greater

(Continued on page 114)

Tobacco plantation in the Province of Guayas, Ecuador.

Colombia's Plantation Rubber Program

To meet the vital need for a steady supply of rubber, a number of plantings of Hevea rubber trees have been established in tropical America. One of these projects is under way in the Urabá region of Colombia.

by HANS G. SORENSEN

Long before it reached the United States the war brought into sharp focus the distance between us and our Far Eastern sources of rubber, just as it brought ever-increasing demands for this product. For two decades before our entrance into the war the desirability of careful examination of the possibilities for establishment of Hevea rubber plantations in the Western Hemisphere had already been stressed by officials of the Department of Agriculture and others interested in the products of tropical agriculture.

In June 1940 Congress authorized a reconnaissance of the rubber-cultivation potentialities of tropical America, the native home of the rubber tree, and provided funds for the purpose. The proposed survey was dependent, of course, upon the interest and cooperation of the various Latin American countries lying within the range of Hevea. They responded with enthusiasm, and intensive work was begun almost within a month of the authorization.

From the beginning it was apparent that Colombia offered several areas suited for Hevea planting and that Colombian interests might be willing to encourage a program of planting if materials and technical assistance were available. The field reconnaissance in Colombia in 1940 and 1941 was made by two groups consisting of trained agronomists, botanists, plant pathologists, and soils experts from the U. S. Department of Agriculture and the Department of Agriculture of Colombia. Five areas were selected as meeting the basic requirements of sites for plantation development: (1) between the Mutatá River and Turbo in the Urabá region of the Department of Antioquia; (2) east of the town of Juradó in the upper reaches of the rivers Truandó and Saliquí, and on the Juradó River; (3) certain areas south of Acandí in the Intendencia of Chocó; (4) part of the property of the American-Colombian Corporation near the confluence of the Cauca and the Magdalena Rivers south of Brazo de Loba; and (5) areas south and east of Santa Marta in the Department of Magdalena.

Boys of Church Agricultural School, Riogrande, Urabá, Colombia, clearing forest land for use as cooperative Hevea nursery.

In any summary of the Colombian plantation program credit must be given to Dr. Miguel Lopez Pumarejo, former Minister of National Economy, now manager of the Caja de Crédito Agraria, Dr. Cesar Garcia Alvarez, former Minister of National Economy and now Director of the Fomento Section under the Caja de Crédito Agraria, Dr. Rafael Rivera H., who has been in charge of the project during the last 2 years, and Frank Sierra Soto, able Colombian Agronomist, as well as to many other persons including Dr. Santiago Rivas Camacho, former Minister of National Economy, Dr. Carlos Madrid, Dr. Jorge Gutierrez, and Dr. Eduardo Mejia Velez, all former Directors of Agriculture under the Ministry of National Economy.

Urabá Region Selected for Project

Of the five regions mentioned, the Urabá is considered to be the one of most interest with regard to rubber cultivation. It possesses large areas of good-quality virgin land, and the Inter-American Highway, designed to be finished by 1947, will pass through it from one end to the other. In order to take full advantage of this new means of communication, the greatest possible development of all

the good lands along the route is, of course, a matter of great importance. Of equal significance, because of the extreme changes in climatical conditions, is the choice of the right crops for the various localities.

The map of Urabá shows that the region has been divided into three zones. Zone 1 has an extremely high yearly rainfall—250 to 350 inches—with about 300 rainy days. For this reason it is considered suitable only for growing valuable timber trees, such as cedros, teak, and certain hardwoods, on a plantation scale. Sufficient cattle raising to meet local demand also can be considered good economy, since the land is suitable for the production of elephant grass.

Zone 2 has less rain and fewer rainy days but the precipitation—160 to 240 inches, with about 200 rainy days—is still too high for general tropical agriculture. It is, however, considered highly suitable for rubber, barbasco, abacá, and valuable woods, and fairly suitable for bananas and elephant grass and the raising of hogs and cattle. The soils consist usually of a friable gravelly clay with excellent natural drainage. They are also fertile, in terms of tree growth or of any other plants having a deeply penetrating root system, but, because of the rather high rainfall, they would soon give out if such crops as rice, corn, or other shallow-root plants were raised. Even if soil erosion could be prevented fairly well, there would be no sure season in which to harvest such crops by mechanical means, and the region, therefore, could not compete, in the same crops, with regions having better-defined dry seasons during which seeding and harvesting can be performed by machinery.

Zone 3 has a medium tropical rainfall, usually with a well-defined dry season of about 2 to 2½ months during January, February, and March, and a short semi-dry season during midsummer. The zone, as a whole, is suitable for most tropical crops, including corn and rice.

A fourth zone, not shown on the map, between Turbo and the Caribbean Sea, has a somewhat lower rainfall than zone 3 and has more-pronounced dry seasons. It includes the fertile areas on the Mulato and San Juan Rivers. As a whole the zone is suitable for most tropical crops.

Agreements Signed

After the termination of the surveys, an agreement was signed in January 1941 by representatives of the Ministry of National Economy of Colombia and of the Bureau of Plant Industry of the U. S. Department of Agriculture. This agreement provided for the establishment of various nursery plantings in one or more of the suitable rubber regions in order to produce a number of Hevea seedlings to be used as rootstock for later demonstration plantations and in that manner lay the foundation for a rubber industry in that country.

The U. S. Department of Agriculture agreed to furnish the necessary planting material and technical assistance.

The Urabá region, in which the rubber plantations are located, is in the western part of Colombia and follows the course of the Inter-American Highway.

Since 1925 Hans G. Sorensen has held important research and developmental posts in connection with tropical agriculture in the Americas, mostly in the sugarcane and rubber industries. For the past 16 years he has been associated with the U. S. Department of Agriculture and is at present Senior Agronomist in Rubber Investigations, Bureau of Plant Industry, Soils, and Agricultural Engineering.

The Colombian Government, under the management of the Caja de Crédito Agraria, would undertake the rest of the expenses in connection with the establishment of nurseries and plantings. Work was begun with two Colombian agronomists, Dr. Luis Arenas and Dr. Juan Giraldo, assigned to the project, and three nurseries were started, one at Acandí, one at the Turbo River, and one at Apartadó.

In 1942 an expansion of the first agreement was signed which included the establishment of three demonstration plantations with a total area of 3,000 to 3,700 acres. Also, two additional nurseries were started, one at Riogrande, the other at Villa Arteaga. This place was formerly an Antioquian government farm established some 20 years ago. The idea at that time was to make it a demonstration and propagation center for tropical crops to promote interest among the small farmers in the region and furnish them with plant material suitable for local conditions. Because of difficult communication at that time, however, the original idea was abandoned and only about 500 acres of land were cleared for pasture in order to raise livestock and to distribute the yearly surpluses among the settlers.

When the rubber project got under way and the adjacent lands, as well as the lands of Villa Arteaga, were found to be suitable for Hevea cultivation, the Antioquian Government gladly turned the entire area over to the Federal Government for the establishment of a demonstration plantation and general headquarters for the rubber project. The site was desirable, not only because of extensive and good areas in the zone but also because of the completion of the Inter-American Highway up to that point, which makes it only one day distant from Medellín by car. The necessary buildings for the technical staff at Villa Arteaga are now completed.

Leaf-blight-resistant clones in the Villa Arteaga budwood gardens.

Planting Program Started

The planting program was begun in February 1944 with selection of land and clearing of virgin forest. Estimates had been made that with material propagated up to that time it would be possible to plant 1,200 acres during 1944. The goal, so far as the clearing was concerned, was reached, but the planting fell short of the estimate because of poor budding results.

By November 1944, fully 1,250 acres had been cleared and the basic improvements, such as bridges, drainage, and 37 miles of roads between the 10-acre plots, had been made on this area. Although the lining and holing were done on 825 acres, only about 300 acres were actually planted up to that time. The material budded had been adequate for some 740 acres of planting; however, the terrific devastation of nursery seedlings caused by the leaf blight reduced the percentage of success to only 22 percent of the total. Spraying was attempted, but various difficulties inherent in the establishment of a new crop in an undeveloped region prevented success in checking the disease by this method.

Fortunately, 100,000 seedlings had been established at Villa Arteaga in 1943 with seed obtained in the Leticia region in Colombia, where the *Hevea brasiliensis* grows wild in the rain forests. These seedlings soon showed an unusual resistance to the leaf blight. They are so resistant, indeed, that they can grow right beside severely diseased material of Eastern derivation without being affected at all. Resistant seed is known to be obtainable from other parts of the Amazon Valley, for instance in the Acre Territory, but usually a certain percentage of the seedlings from such seed are infected. The Leticia material is outstanding in that not a single plant grown from it so far has lost its leaves by disease.

Progress of the Project

During 1944 some 42,000 additional seedlings were obtained from Leticia, and the plan is to obtain in 1945 about 350,000 more seeds, a sufficient number to complete the planting of 3,000 acres at Acandí, Turbo, Riogrande, and Villa Arteaga. According to present plans, each of these plantations will serve as a demonstration center for a later colonization plan.

Material for use as budwood has been rapidly multiplied. During the budding season of 1944 only 5,000 clonal plants were available, but by May and June 1945 there will be at least 20,000 sticks of budwood available, more than enough

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The Royal Palm in Cuba

The Royal palm is one of the most graceful and majestic of all palms. Silhouetted against the tropical sky, it is a conspicuous feature of the Cuban landscape. It grows almost everywhere on the island and serves many useful purposes for the people.

by JULIAN C. CRANE

When sea-weary explorers from Europe first came to Cuba, they found the stately Royal palms growing there. These majestic trees have clean stone-gray boles, or trunks, which resemble concrete columns, topped by a huge "plume," as one writer calls it, of long, feathery, spreading leaves. With these graceful leaves of various shades of green undulating in the breeze, or seen sharply projected against the blue Cuban sky, the Royal palm baffles description. No wonder its seeds were carried about the world and Royal palms now stand along grand avenues far from the West Indies!

A Conspicuous Feature Of the Cuban Landscape

The Cuban Royal palm, *Roystonea regia,* known also as *palma maxima* and called *palma real* in Cuba, is one of the

most conspicuous features of the Cuban landscape. The names were probably received on account of its height and truly magnificent, graceful, wavy foliage. The tree is found in all parts of the island except in the higher mountains and places where the soil is poor and arid, and it is a constant reminder to the northern visitor that he is, indeed, in a strange land.

The tree is abundant, especially in the moist rich soil along streams and rivers and on soils suited to the cultivation of sugarcane and tobacco. The vast majority of palms now existing in Cuba, particularly in the western part of the island, stand on land which was cultivated at one time or another and later abandoned. In such locations the palms were able to obtain a foothold before the competition of other plants became too strong. In the more highly cultivated areas they often occupy the hedgerows, thus being arranged in double rows along the roadways—one on each side of the road—and in single rows along the dividing lines between fields. This arrangement is largely accidental, cultivation compelling the absence of the young plants from the fields, and the hedgerows offering a secluded habitat until the young trees are strong enough to need no shelter. The tree is used considerably to line the drives leading to plantation managers' homes and is frequently seen bordering wide avenues in some of the newer residential districts. The perspective effect of these long straight rows of slender trunks 50 to 80 feet tall is strikingly beautiful. For ornamental purposes the tree can hardly be overestimated.

A visitor to the island wonders how these trees withstand the numerous tropical storms to which they are subjected. The answer lies in the fact that they are held fast by a dense mass of fibrous roots which enable the tree to carry the great stress of high winds. After the Cuban hurricane of October 1944, during which the wind reached a velocity of 150 miles an hour, the author saw numerous palms standing headless at full height when the entire crown had been blown away. They looked like gigantic telegraph poles.

Leaf sheaths from the Royal palm have a wide number of uses but are particularly suitable for construction of farm houses and sheds and for wrapping tobacco.

Mortars and pestles made from the trunk of the Royal palm are used for threshing rice. Note the palm-thatched roofs in the background.

Uses of the Trunk

The trunk is smooth and whitish- or stone-gray in color, closely resembling the color of concrete, and it is more or less conspicuously marked by circular rings which are the scars left by fallen leaves. Since it has a white pithy center, through which numerous small strands of fibrous woody tissue are dispersed lengthwise, the trunk cannot be used commercially, as a log, for lumber or fuel. Surrounding the pulpy center, however, is a dense shell of hard wood 2 to 3 inches in thickness, and this is highly esteemed on account of its hardness, weight, and durability.

In the country districts of Cuba this layer of hard wood is utilized for a great variety of purposes. One of the uses is for making fence posts. The felled trunk is left exposed to the weather for some time to allow the interior to rot, and the outside layer is then cut into lengths and split.

The author is Associate Agronomist in the Office of Foreign Agricultural Relations and for some time conducted experimental work in collaboration with the Cuban Ministry of Agriculture.

Picket fences are likewise made of strips of the wood tied upright to long cross pieces and close enough together to prevent chickens from going through. Small trunks, or more often the top portions of large trees, are used as columns or as the main supports of rural *bohios* or houses.

It is not uncommon for a bulge or thickening of the trunk to occur far above the ground, usually about the middle but sometimes near the top where the trunk emerges above dense undergrowth. The extent of the swelling, as well as its length and position, depends on the particular habitat, the age of the tree, and whether it is alone in the open or is crowded in the forest.

The Cubans take advantage of this feature in fashioning useful articles from the bulge portion of the tree. Perhaps the most useful implement made is the mortar for crushing roasted coffee beans or for threshing rice. The wide end of the bulge section, which has been cut out of the long trunk, is hollowed out and the smaller end is shaped to make a supporting base or is fitted into a larger base to hold the section firmly upright. With a pestle cut out of similar or different wood, this makes a cheap and practical mortar and pestle. When not in use, the instrument may be used to hold the family supply of beans or it is always handy to support the family washtub, a broad tub made often of the same wood. Massive chairs, stools, and other articles of furniture are also made from the bulge portion of the tree, and these are seen occupying prominent places in the Cuban rural household.

Uses of the Leaves

Although the uses of the trunk of the Royal palm are numerous, they appear quite inconsequential when compared with those of the 20 or so long graceful pinnate leaves which form the plume. The most important part of the leaf is the yagua or long sheathing base which alone furnishes the rural Cuban with many of his necessities. These overlapping sheaths form a cylinder completely around the topmost portion of the trunk, tightly enveloping the vegetative cone. Each sheath is from 4 to 9 feet long and, when flattened out, is equal in width to the circumference of the trunk. Terminating the upper end of each of the 20 clasping sheaths is a long feathery pinnate leaf blade. Before the emission of a new leaf, the lowest leaf in the plume, with its sheath, is shed, leaving the trunk quite clean but more or less distinctly ringed. A characteristic sign of the Royal palm is one of these single dead leaves hanging underneath the crown. Commonly it falls with a crash before the next leaf is ready to droop and fall. A person keeps a sharp lookout when walking beneath Royal palms in order to keep from being hit by a falling 40- to 50-pound leaf.

The leaf bases or sheaths are gathered immediately after they have fallen to the ground and are dampened and flattened by means of weights. After they are thoroughly dried, they are tied into bundles of convenient sizes and offered for sale. There is a good market for them in the tobacco-growing regions of the island. Formerly nearly all of the tobacco that was sent to the United States and to Europe was carefully wrapped in these leaf bases, and no material is considered to be better suited for the purpose. Even today they are used to a considerable extent.

Narrow strips torn from the edges of the sheaths afford inexpensive yet efficient tying material. In the country districts of Cuba palm leaf bases furnish a most important portion of the string which is used in the twisted or untwisted state.

The leaves and their sheaths also enter into the construction of houses. One is interested to see, in some of the sections where the Royal palm is abundant, houses built almost entirely of this material. In fact, a large proportion of the houses of the poorer classes are thatched or sided with yaguas, which are trimmed and tied to the framework of the house in a manner similar to that of shingles or tiles on the roofs of houses. Nails are rarely used to fasten them in place; rather, they are generally tied to the rafters with leaf strings.

Strange as it may seem, the leaf sheaths, in addition to serving as construction material, are used to make various articles of clothing and household use. By cutting a hole in the middle large enough for the head to pass through and bending down the two halves so as to cover the front and back, a person may make the sheaths into raincoats which shed the heavy tropical downpours. Curved pieces of the sheaths, cut to the right size and tied with string of the same material, make excellent leggings for the *guajiros* or country men. The inside skin of the sheath, when peeled off while green and then dried, is said to have been used as paper during the Cuban War of Independence.

(Continued on page 115)

Freshly cut *palmiche*, heavily loaded fruit clusters, are used extensively as feed for hogs. After the fruit has been removed, the branches of each cluster are tied in the middle and used as brooms.

Inter-American Cooperation In Agricultural Education

Agricultural education is one of the important channels of inter-American cooperation. An Advisory Committee on Inter-American Cooperation in Agricultural Education was appointed in 1940 and has been functioning effectively since that time, as this article shows.

by PHILIP LEONARD GREEN

In 1940 a number of committees were formed to advise the Division of Cultural Relations, now the Division of Cultural Cooperation, of the Department of State with regard to policies and procedures in the respective fields of their competence. The Advisory Committee on Inter-American Cooperation in Agricultural Education, as its name indicates, was set up to advise the Department of State in the realm of agriculture.

Membership

Present membership of the Committee is made up of the following agricultural leaders in the United States: Homer H. Henney, Colorado State College, present chairman; Dr. Richard Bradfield, Cornell University; Dr. T. W. Schultz, University of Chicago; Dr. H. H. Hume, University of Florida; Knowles A. Ryerson, University of California; E. J. Kyle, Agricultural and Mechanical College of Texas; Dr. Ross E. Moore and Dr. Louise Stanley, U. S. Department of Agriculture; Dr. John C. Patterson, U. S. Office of Education; Dr. Thomas Barbour, Museum of Comparative Zoology, Cambridge, Massachusetts. The membership has remained substantially the same with additions made from time to time with a view to securing the benefits of wider territorial and professional representation.

Objectives

The Advisory Committee on Inter-American Cooperation in Agricultural Education grew out of suggestions originally made by the Continuation Committee of the Conference on Inter-American Relations in the Field of Education, held by the Department of State on November 9 and 10, 1939. These suggestions were communicated by Secretary of State Cordell Hull to Secretary of Agriculture Henry A. Wallace, who on June 10, 1940, wrote a letter appointing the original Committee and outlining its functions in general terms.

The objectives outlined in this letter were: (1) To indicate to the land-grant colleges the keen interest that is felt in the attention they give to the Latin American situation through the teaching of Spanish, making special provision for the needs of Latin American students, and similar activities. (2) To show that, although there are already some schools that are interesting themselves in the Latin American situation, there is still plenty of opportunity for others to serve. (3) To point out the particular advantages of various schools. (4) To exchange ideas and stimulate interest in agricultural education, not only for students from Latin America but also young North Americans interested in the Latin American field. (5) To explain the aims of the institute projected under the name Tropical Institute of Agriculture and later organized as the Inter-American Institute of Agricultural Sciences.

Activities

The Committee has met on seven occasions in 2- or 3-day sessions, as follows: November 1940; May and November in 1941 and 1942; May 1944; and January 1945. At these meetings the Committee has been greatly assisted in its deliberations by numerous authorities from public and private agencies who have graciously given of their time to participate in its discussion.

Questions to which the Committee has addressed itself range through every phase of agricultural and rural life, particularly those bearing a relation to agricultural education.

For example, the Committee from the very beginning went on record as being in favor of our Government's appointing agricultural advisers to our Embassies in the other American republics. This policy is now being carried out

The author of this article is a Latin American Specialist in the Division of Extension and Training, Office of Foreign Agricultural Relations, and has served as Historian of the Advisory Committee on Inter-American Cooperation in Agricultural Education since its inception in 1940.

with considerable success. It has assisted the American Association of Land Grant Colleges and Universities in special sessions of its annual meetings devoted to inter-American agricultural cooperation. The Committee, as early as 1942, came out in favor of training programs at the cooperative agricultural experiment stations in which the United States participates with certain other American republics. It has repeatedly called attention to the need for expansion of facilities for the exchange of information in English, Spanish, and Portuguese on developments in agricultural research.

The subject of agricultural professorships, fellowships, and scholarships, including such factors as candidates' qualifications, has been an important sphere of interest to which the Committee has brought considerable advice, encouragement, and impetus. The Committee has also urged that more attention be given to the training of hospital technicians and medical practitioners in tropical agricultural areas, as well as of agriculturists who will "work with their hands." Conversely, the Committee has called attention to the importance of teaching Spanish, Portuguese, and Latin American history and geography in the United States and has commended those institutions in this country which have included courses on these subjects in their curricula.

The desirability of integrating educational activities in the fields of agriculture, engineering, and forestry has been stressed frequently by the Committee.

On several occasions the Committee has expressed commendation for pertinent activities in the field of its interest, such as the in-service trainee program in the U. S. Department of Agriculture; the compilation by the Institute of International Education of a master list comprising foreign students registered at United States institutions of higher learning; the Garden Club of America for its aid to the Colombian Garden Club; the Inter-American Conferences on Agriculture; the Mexican-American Joint Commission; the David Burpee scholarships; and the U. S. Office of Education for its work in compiling a directory of Latin American agricultural schools and a list of Latin American alumni of agricultural colleges in the United States, at the Committee's request.

The most important topic discussed at the Committee's meetings from the very beginning of its history has been the Inter-American Institute of Agricultural Sciences. Aside from encouraging the idea of such an institute at a time when it was nothing more than an idea, the Committee has exercised its good offices in securing some of the funds needed for the organization of the Institute, has offered suggestions as to curricula, qualification of students, and use of the physical plant, has recommended that the Library of the Tropical Plant Foundation be given to the Institute (which has been done), and has made itself generally available at all times for consultation on the Institute's problems.

The problems which gave rise to the Committee's appointment will not disappear automatically at the end of the war. Even as the struggle continues, peacetime plans begin to occupy an evermore-important place in the deliberations of official and private bodies concerned with inter-American

Courtesy of Soil Conservation Service.

One part of the inter-American cooperation in agricultural education is the valuable Trainee Program carried on through various Divisions of the U. S. Government. Here two trainees from Brazil study soil erosion problems with the owner and tenant of a Texas farm.

affairs. In a rapidly changing world the participating of groups such as this Committee will be found increasingly useful in providing a reservoir of ideas, guidance, and encouragement for all efforts toward closer inter-American agricultural cooperation.

LATIN AMERICAN TOBACCO

(Continued from page 105)

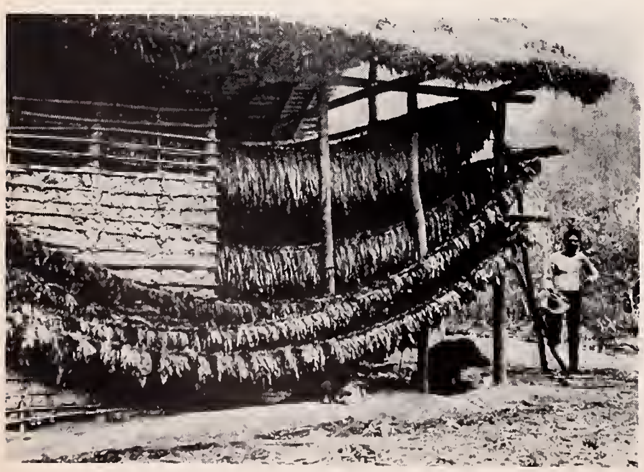
absorption of the moistening liquid. The finished product is a hard glistening roll called *fumo em cordo,* sold on the local markets by measure or weight at a price equal to 8 or 9 cents a pound. It is smoked in pipes or in hand-made cigarettes and represents about 40 percent of the total tobacco consumption in Brazil.

Cuba's Tobacco

Tobacco is an important crop in Cuba, ranking next to sugar. Havana tobacco, like many others of Latin America, has been known to the world for centuries. The United States cigar industry uses more tobacco from Cuba than from any other foreign country. Cuba has a soil and climate peculiarly adapted to the production of cigar tobacco, and Cuban growers, in general, have held to the production of cigar tobacco only. The wisdom of this policy has been demonstrated in the success of their industry. Cuban tobacco exports in 1944, including cigars, amounted to nearly 80 million dollars.

Colombian Tobacco

Colombian tobacco has been known on world markets since about 1625. Carmen and Ambalema were the varieties best known then, and Bolivar was the center of production. Today Santandar, Tolima, and Bolivar produce about 80 percent of the crop. Germany, having used Colombia tobacco in cigar manufacture since Spanish colonial days, in 1938 more than doubled its imports of Colombian leaf, against a time when shipping facilities might be difficult.



Curing "cowstongue" tobacco, Venezuela.

Since the war Colombia has lost the major part of its export market.

Paraguay's Tobacco

In Paraguay tobacco was being cultivated by the Guaraní Indians before the discovery of America. Commercial production began about 1700. Spanish authorities fostered the industry carefully to obtain the greatest possible yields, since Paraguayan tobacco was even then in favor on the Spanish market. As production continued to develop during the years, tobacco became first in importance as an export product. Since, prior to the present war, Paraguay's tobacco was sold almost exclusively to the Netherlands, Belgium, and Germany, that country's industry has been seriously affected by the situation now prevailing in Europe.

The Paraguayan market demanded two distinct types of tobacco: Strong red tobacco for domestic consumption and for export to neighboring countries, and mild aromatic types of a lighter color for export to Europe. About 1900 the Banco Agrícola introduced seeds from Cuba for the purpose of improving the indigenous varieties. Later, Bahía and North American seeds were brought in, but the new varieties were not altogether acceptable because of fear of cross pollination. Some opposition was also registered by Germany, an important European buyer. Two schools of thought still exist, one holding to the idea of purifying and improving the domestic varieties on the ground that the most successful tobacco industries in the world have been built around indigenous varieties, and the other planning for a share in the increased demand for light cigarette types.

With the exception of Cuba, whose principal leaf market is the United States, and of Brazil, which markets both leaf and rope tobacco on the South American Continent, practically all the Latin American tobacco exporters depend upon Europe for their main foreign market. In the confusion and chaos incident to the present World War and its aftermath some years may pass before the European demand for Latin American tobacco returns to normal. Until that day the Western World might do well to concentrate on the improvement of domestic tobaccos and the potentialities of home markets.

RUBBER PROGRAM

(Continued from page 108)

for the budding of the present available resistant rootstock. The limitation of rootstock will necessitate carrying the planting program into 1946.

Planting has been done mostly with selected Eastern clones. For topwork and also for planting in mixture with the Eastern clones, some Ford clones that are resistant and, most likely, fairly high-yielding have been propagated.

At the Apartadó nursery there were about 6,000 seedlings of *Hevea spruceana* which had been obtained by seed

Five-month-old resistant seedlings at the Villa Arteaga nursery.

from the vicinity of Manaos, Brazil. Many of these seedlings were budded, but experience showed that this species does not make a good rootstock. Some of the buddings grew well; others were dormant for months before they began to sprout. Budding on *H. spruceana,* therefore, has been discontinued, but one block, about 10 acres, will be planted with 50 percent *H. spruceana* stumps and 50 percent of resistant Ford selections in order to obtain a supply of hybrid seed.

Experiments in the Far East have shown that hybrid stock of *Hevea brasiliensis* crossed with *H. spruceana* yields from 15 to 32 percent more than *H. brasiliensis* rootstock, all other factors being equal. In a few years a good supply of such seed can be obtained from the mentioned block, and this should provide valuable material for the future extension of the rubber program in Colombia.

The successful completion of these plantations in 1946 and of the Highway in 1947 will conclude the first phase of a long-range program of the Colombian Government for the agricultural development of this immense rich Northwest frontier area.

THE ROYAL PALM

(Continued from page 111)

Uses for Food

Although the Royal palm does not bear fruit of much commercial use, the large clusters of fruit, called *palmiche,* with their many small kernels having an oil content of about 18 percent are used extensively as feed for hogs. These fruit clusters are harvested by nimble Cubans who ascend the straight tall trunks with the aid of ropes. The cluster is severed with a sharp knife and is lowered to the ground by a rope in order to prevent shattering of the numerous fruits. The many branches of the fruit stalk are tied in the middle after the fruit has been removed and this article is used as a broom. It is a common implement in every Cuban rural household.

This versatile tree has another food use which should not be overlooked. The young tender shoots which comprise the terminal bud of the tree are utilized as a vegetable and made into a delicious salad. It may be eaten raw, fried, or boiled, and it is highly esteemed as an article of food, especially boiled. Upon the removal of the terminal bud, however, the tree dies.

The Royal palm plays so large a part in the life of the island people that it is carefully guarded and preserved. It may well be called the national plant of Cuba.

ALONG THE *Agricultural Front*

▲ U. S. Farm Census To Give Valuable Data

The 1945 Census of Agriculture, which was started last year, is now near completion and the results will be available early this fall, according to J. C. Capt, Director of the Bureau of the Census, U. S. Department of Commerce. The census covers every farm in the United States and will include basic information on farm acreage, crops, livestock, farm labor, and other items related to farm operations. An agricultural census is carried on every 5 years, the first one having been made in 1840.

Since this is the first farm census made since the entrance of the United States into the war, it should provide the U. S. Government with many necessary facts regarding the amount of food that can be supplied to the Allied and Liberated Nations by this country. The data should also aid farmers in plans for shifting their operations from the wartime economy to peacetime production and serve as a guide to all concerned with agriculture in planning postwar changes in acreage of particular crops and in classes of livestock, as well as for making credit and other business transactions both domestic and foreign.

▲ Proteins For Cattle From Living Fence Posts

As a result of the article on "Living Fence Posts in Cuba" in the February issue of *Agriculture in the Americas,* Atherton Lee, Department of New Crops, United Fruit Company, stationed in Central America, wrote this interesting statement on the living fence post as a source of proteins for cattle:

"The valuable article 'Living Fence Posts in Cuba' by Julian C. Crane prompts this short note concerning two sources of proteins for dairy animals and beef cattle. Two of the living fence posts mentioned in the article are *piñón de pito* (*Erythrina berteroana*) and *bucare* (*Erythrina poeppigiana*); dairy animals eat the leaves of these two species avidly. Analyses of the leaves of these two species made at the Puerto Rico Experiment Station in 1936 showed a crude protein content, on a fresh-green-material basis, of 5.37 percent for *E. berteroana* and 8.3 percent for *E. poeppigiana.* We used both of these *Erythrinas* for coffee and cacao shade, vanilla supports, and living fence posts, and made a practice of pruning while the limbs were in full leaf for feeding such prunings to our dairy animals.

"We also found that our calves fed avidly on the prunings from our living fence posts of *piñón amoroso* (*Gliricidia sepium*). Mature cows which had not fed on the *Gliricidia* when calves would not touch these leaves but cows which had developed the habit of feeding on them when calves persisted in such feeding habits. Since this *Gliricidia* is also a legume, we suspected it of being high in proteins although analyses of such foliage were not available to us.

"Since milk yields are usually low in the Tropics, and the protein content of their diet is so important in this connection, these data may be of value."

▲ Flax Plant Fungus in Rio Grande do Sul

A plant fungus known as *Spaerella linorum wollenweber* has been attacking flaxseed plantations recently in the western part of the Brazilian State of Rio Grande do Sul near the Argentine frontier. It is not a new parasite, for it has been reported many different times and in many localities in the State during the past few years, and the Federal Ministry of Agriculture and the State Department of Agriculture have been working on the problem in various ways. It is a serious disease in view of the importance of flax for oil and fiber in the economy of Rio Grande do Sul.

Signs of the disease become evident a short while before the flax is ripe, by the appearance of brown spots. New plants attacked by the fungus wither and die. The disease is called flax spasm.

One method of fighting the fungus is the development of fungus-resistant varieties. Experimental stations working with a number of varieties of flax have found one known as Klein 11 to be widely adaptable to all Rio Grande do Sul climatic and soil conditions and slightly more resistant to the fungus than are Klein 18 or Klein 101. This variety came originally from Argentina.

Another method recommended by the Department of Agriculture is the use of crop rotations. Where flax is grown in the same soil year after year the fungus is said to be more pronounced. Still another is to treat the seeds by sprinkling with formalin solution a day or two before planting.

▲ Work Succeeding at Camohmila YMCA Center

On land formerly considered "absolutely no good" crops are growing successfully at the Camohmila YMCA Rural Reconstruction Center, State of Morelos, Mexico, and the State has renewed for 1945 its grant to the Center's sheep, hand-weaving, and fruit projects.

Tree or bush soyas are proving a valuable crop at the Center. This hardy perennial puts its roots down so deep that, without watering, all through the 7-month dry season beans are available when nothing else is producing. Since the soya bush produces all the year round, yellow flowers, green beans, and ripe beans are on the plants simultaneously. Alfalfa, sizable sweetpotatoes, figs, blackberries, and rozelle or "Jamaica" (for making jelly and a refreshing drink) are all growing successfully after improvement of the soil by the use of compost and green manures.

Grade Poland China pigs, black and white sheep, Granadina goats, pigeons, Pekin ducks, and crepe-de-chine turkeys are among the breeding-experiment projects that are in progress. Young people are learning to weave, and doctors and nurses are extending their health service from the clinic at the Center to several villages.

"Camohmila is our first [YMCA] Rural Reconstruction Center in the Western Hemisphere," the report of the project states. "With eleven rugged villages as its extension field, it seeks first to learn what is good and then to teach rural families how to help themselves upward on all sides of life."

▲ New Tree For Shade of Cacao

Shading has long been regarded by some planters as desirable to keep cacao trees from being burned by the sun. Formerly the practice was, when the forest was cleared for planting, to leave forest trees standing at convenient intervals to provide shade. The more approved modern practice is to plant among the cacao trees at regular intervals a fast-growing leguminous tree which will provide the right amount of shade and at the same time enrich the soil with nitrogen captured from the air. The tree used at the Agua Preta Experiment Station and on a number of private cacao plantations in the State of Baía, Brazil, for experiments in shading has been *Erythrina velutina,* often called "Mother of Cacao."

Now the suggestion of another tree to be used as a substitute for *Erythrina* comes from the Rio de Janeiro Botanical Garden. It is *Clitoria racemosa* (Benth.), an ornamental leguminous tree which has unusually quick growth, a wide-spreading crown, and relatively open development of leaves and branches. There are potential secondary values in the oil-bearing seed of the tree. Recent tests indicate that the *Clitoria racemosa* seed contains approximately 22 percent oil and more than 8 percent protein. The oil is edible and clear, with a pleasant odor recommending it for kitchen use as a substitute for olive oil. An examination of the oilseed cake indicates a protein content of 30 percent. The tree bears seed after 5 to 6 years and the annual yield is expected to average about 22 pounds. The wood of the tree is harder than that of *Erythrina velutina* and can be used for making charcoal and in a limited way as lumber.

URUGUAY RIVER BASIN

(Continued from back cover)

about 90 percent white. The estimated population in 1940 of the following important ports was: Uruguaiana, 41,000; Paysandú, 40,000; Salto, 35,000; and Fray Bentos, 8,000. Adjacent to the urban centers the population averages about 14 per square mile in most of the basin, but is less than 10 in the northern area.

Transportation

The Uruguay River is navigable for 14-foot-draft ocean-going vessels for 200 miles to the important port Paysandú. Beyond that point northward to Salto, the maximum allowable draft is 9 feet. Falls and rapids immediately above Salto prevent navigation farther north. Beyond these falls, however, navigation is open for light-draft river boats for about 300 miles, above which the river, though of considerable size, is not suitable for navigation because of rapids and many small islands.

The Río Negro is open to navigation as far as Mercedes, an important port and railroad center. Other tributaries of the Uruguay vary in length from 50 to 160 miles and are navigable only for distances varying from 15 to 30 miles.

In addition to the transportation furnished by the river an efficient railroad system connects the principal cities within the basin with the coastal area. There is also a good highway system, and a number of airports have been established throughout the basin.

Resources

Crop production has never been important in the basin though the rich alluvial soil is suitable for growing cereals and various temperate-climate fruits and vegetables, and no great increase in the cultivated land area is likely because of the desirable conditions for raising livestock. The cultivation of vineyards is, however, increasing, and a great variety of vegetables are grown around the population centers on the river. Wheat, flax, and corn are the principal crops grown in the outer fringes of the basin, which are similar to the adjoining areas where heavy production is found. The production of rice, beans, potatoes, and yerba mate is scattered throughout the basin.

The luxuriant vegetation cover and the ample supply of water distributed by the many rivers and streams make the basin ideally suited for the continuation of livestock production, which has always been the principal economic activity, and there is no strong inclination toward the utilization of the vast plains for other purposes. The quality of meat and wool has been improving steadily for many years, since high-quality breeding stock has been brought into Uruguay, principally from England and Argentina. Now native stock is seldom found in any section. The cattle, largely Hereford and Durham, are raised almost entirely for beef. The dairy industry has never been greatly developed.

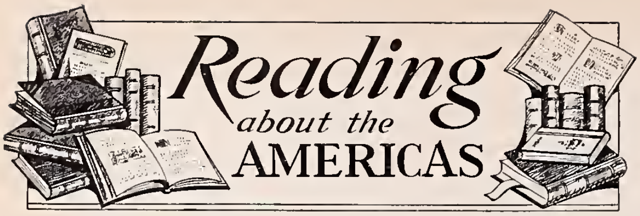
Grazing on the plains are found vast herds of cattle and sheep and a much smaller number of hogs, horses, mules, and goats. Horses are important and are perfectly trained for work on the ranches.

The Gaucho, or cowboy, is a colorful figure. Driving and herding cattle is a profession to him and he has no desire to till the land and cultivate crops. He prefers the free open life on the cattle and sheep ranches. He learned to ride horses in his childhood and hardly leaves his saddle except to sleep.

The preparation of meats and meat products for export is the principal industry of the basin. By the middle of the nineteenth century the salting of beef and the preparation of tasajo (jerked beef) had attained considerable importance. In 1905 the first *frigorífico,* or freezing plant to produce frozen and chilled meat, was established in Fray Bentos. Since that date others have been built at Paysandú and Salto, also important river ports. Considerable rivalry has developed between the *frigoríficos* and the original meat-salting and -jerking establishments, called *saladeros,* with their primitive, though successful, methods of drying beef. Refrigeration has played a vital part in establishing economic stability in the basin. Any conspicuous change in the production of beef in this area is not likely, as on the whole the grazing lands are well stocked. The chief exports from the basin are wool, meats, and hides.

There are few mineral deposits in the basin, though marble, granite, and limestone are found in the highlands, and in the Departments of Salto and Artigas there are opals, agates, and onyx.

The economic welfare of the basin as a whole has for many years been closely associated with the price of meat and wool. When a more orderly economic pattern has been established in the world, the international markets for meat and other livestock products will, perhaps, give the area a much greater economic prosperity than it has ever had.



Chile, An Economy in Transition, by P. T. Ellsworth. 183 pp., charts and diagrams. The MacMillan Company, New York, 1945. The author discusses Chilean economy, stressing foreign exchange problems, inflation, banking, and foreign trade controls. In the last chapters he gives suggestions for comprehensive changes in the social order of the country—the need for roads, low-cost housing, health education, agricultural development, industrial expansion and diversification, and higher standards of living. A recommendation is discussed for an increase in the production of protective foods, especially wheat and meat, to improve health and the efficiency of labor, thus requiring redistribution and improved use of arable farm land and promoting stability and balance in Chile's economy.

The Argentine Republic, by Ysabel F. Rennie. 431 pp., illus. The MacMillan Company, New York, 1945. The author tells the story of the Argentine Republic "which was founded in 1853," going back to Rosas and the caudillos and continuing through July 1944. One chapter gives the setting—the Pampa, the Gaucho, the City, and the Provinces. Another tells of the boom of the 1860's, immigration, and the coming of the railroads. Still another summarizes the struggle for economic sovereignty. There are two chapters on the land, dealing with distribution of the land, with the estancia, livestock industry, and sugarcane. The book includes an index and a glossary of Argentine terms.

The Annals of the American Academy of Political and Social Science, Vol. 237, January 1945. 257 pp., tables and charts. The American Academy of Political and Social Science, Philadelphia, Pennsylvania. The subject of this number of *The Annals* is World Population in Transition. Among the articles by various authors are two dealing with Latin America: "Demographic Status of South America," by Halbert L. Dunn, Hope Tisdale Eldridge, and Nora P. Powell, and "Population Problems in Central and Caribbean America," by Alberto P. León and Alvaro Aldama C. In addition several articles deal with the subject of population in general.

Timeless Mexico, by Hudson Strode. 436 pp., Harcourt, Brace and Company, New York, 1944. The book is a colorful yet sensible portrayal of Mexico's dramatic history, from precolonial to modern times, written for the purpose of promoting an accurate understanding of the people south of the Rio Grande. Personal acquaintance of the author with political leaders in the neighboring republic lends additional authority to the book.

Irrigação mecânica do Nordeste, by Antonio da Cunha Bayma. 123 pp., illus. Serviço de Informação Agrícola, Ministério da Agricultura, Rio de Janeiro, Brasil, 1944. This Portuguese monograph explains clearly and with technical accuracy what is meant by the term irrigation by pumping, the methods used in Northeast Brazil, and the extent to which this work is being done.

To the South, by Kurt Severin (in collaboration with Lenore Sorsby). 244 pp., illus. Duell, Sloan and Pearce, New York, 1944. Through 25 exclusive photographs a professional photographer has attempted to present the life of part of the people in Latin America. In the text he tells of those people, both in cities and in jungle, showing their art, sports, and superstitions, and the strange customs of some of the Indian tribes. He makes some incisive social observations and concludes the book with a chapter on Latin America's flying future.

De arrendatario a propietario (From Tenant to Owner). 16 pp., illus. Ministerio de Agricultura de la Nación, Consejo Agrario Nacional, Buenos Aires, 1944. A presentation in Spanish of the working plan of the National Agrarian Council. The advantages of the plan, what the Council does for the colonies, the price of lots and methods of payment, required qualifications of purchasers, property title, and designs for extensible houses for colonists are all explained.

Argentine Riddle, by Felix Weil. 297 pp. The John Day Company, Inc., New York, 1944. The author covers politics, labor, agriculture, and industry of Argentina, and relations of that country with the United States. Appendices, tables, and a source list form valuable parts of the book. What the author calls an "excursus" on the injudicious use of statistics proves a balance-wheel to the wealth of figures given.

EDITOR'S NOTE.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

AGRICULTURE IN THE AMERICAS — **O. R. CARRINGTON, EDITOR**

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Gifts of the Americas

THE GUINEA PIG

by JANE W. ROLLER

The domestic cavy, more familiarly known as the guinea pig, is one of the few domestic animals to originate in the Western Hemisphere. Belonging to the world-wide order Rodentia, or gnawing mammals, and to the family Caviidae, which is restricted to South America, the guinea pig comes from the Andean highlands of Peru.

When the guinea pig, *Cavia porcellus* L., became domesticated is not known, but it has served as both food and pet for the Andean Indians for many centuries. While archeological remains of this type are scarce, pots resembling guinea pigs and even the mummified animals themselves have been found in the graves of the Peruvian Indians, whose custom it was to bury personal possessions with the dead.

The origin of the name guinea pig for an animal native to this continent is material for speculation. Some authors consider the name to be a corruption of Guiana, the country in northeastern South America, but there is no reference to the domestic cavy ever having been found there. Other authorities contend that the animal was so called because it was carried from South America to England in slave ships by way of the coast of Guinea in West Africa. Some think that the name was derived from the coin for which the cavy was sold, for during the sixteenth and seventeenth centuries in England it could be purchased for a guinea. No doubt this small engaging creature, averaging 7 inches in length and 2 pounds in weight, having shiny black eyes, silky fur, and inquisitive whiskers, looked foreign to the Europeans, but such characteristics are scarcely descriptive of an ordinary pig. This part of the name probably came from the cavy's resemblance, when prepared for the table, to a roasted suckling pig.

From a culinary point of view the domestic cavy is considered a great delicacy by the natives of the high country of Bolivia and Peru. The animal is killed, scalded and scraped to remove the fur, spread flat, either roasted or fried whole, and served with a hot sauce known as *picante,* which is made from a small hot pepper, the *ají*. This delectable dish may also be purchased already prepared, complete with sauce, in shops known as *picantes*. In Ecuador roasted cavies are sold to travelers at train stops along the railroads. American and English cavy-fanciers' manuals and bulletins on raising the animals contain all kinds of recipes for preparing them for the table.

Within 50 years after the Spanish Conquest, the domestic cavy was established as a food in Spain. From there it was taken to other parts of Europe and the British Isles and finally returned to the New World after undergoing a considerable change in the process of breeding for variety standardization. Cavy clubs and associations sprang up in this country and abroad, where guinea pigs were bred for uniformity in color pattern and type of coat. They were exhibited at pet stock shows, and certain varieties became popular in the fanciers' trade and as pets for children.

We do not know when the cavy was first used for laboratory experimentation. Today the guinea pig is one of the most important laboratory animals. It is used in physiological experiments and in the diagnosis of certain diseases, particularly tuberculosis and bubonic plague as it is extremely susceptible to the organisms causing these diseases. It is used in the preparation of serums and antitoxins, in the standardization of such products, and in nutrition studies, especially in experiments dealing with ascorbic acid, or Vitamin C. The guinea pig and the monkey are the only animals that suffer from scurvy in the same manner as man when this important vitamin is lacking in their diet. These are but a few of the innumerable ways in which the domestic cavy is of benefit to man.

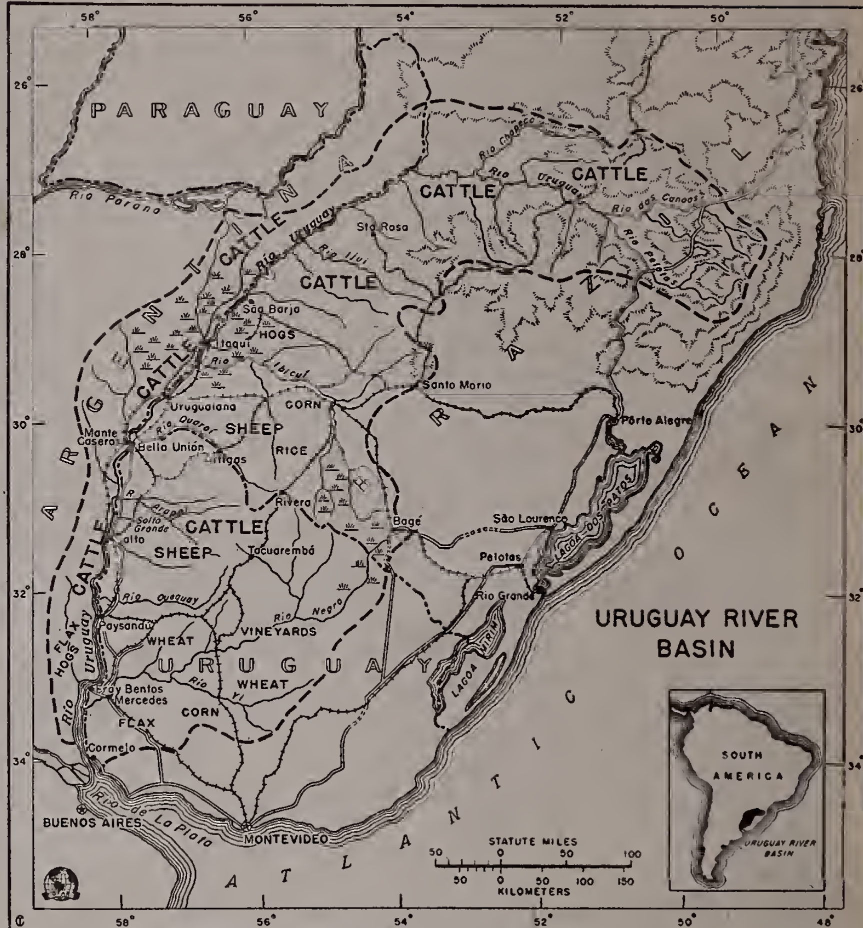
Because it is so easily cared for, the domestic cavy is well adapted to laboratory use. Unlike mice, which are born blind and without fur, newborn guinea pigs are precocious youngsters with fur and open eyes. They are very active and on the day after birth are nibbling at solid food with their parents, although they are not weaned until about three weeks old. The cavy is not the prolific producer that fiction has led us to believe. True, the animal reproduces at an early age, 3 to 5 months, and three or four litters are produced each year, but the litters are small.

From the earthen floors of the windowless huts of the Andean natives to the hospitals and laboratories over most of the world, this gift of the Americas has travelled a long and useful path as pet, food, and experimental animal.

THE URUGUAY RIVER BASIN

by **Ruth Parker Schottroff**

The Uruguay River Basin, in contrast to many other river basins in South America, is free from spectacular extremes in both physical and cultural aspects. It serves as a transition zone between the southern highlands of Brazil and the grasslands of Argentina, and comprises about two-thirds of Uruguay, one-half of the Brazilian States of Rio Grande do Sul and Santa Catarina, and a narrow margin of the Argentine Mesopotamia.



The Uruguay River rises in the Serra Geral in Santa Catarina, within 50 miles of the Atlantic Ocean, and flows west and then south. It is joined by the Río Ibicuí, the first large tributary, just south of Itaquí in Brazil. When it first touches Uruguay, it receives the Río Quaraí, a tributary 160 miles long. At this point it is almost a mile wide and is divided by a line of wooded islands. Its next important tributary is the Arapey. Here the river bed becomes rocky and the current swift, producing the Salto Chico, a cataract of considerable size. Fed by many tributaries, the largest of which is Río Negro, the river grows rapidly until it is from 6 to 10 miles wide. Just north of Buenos Aires, it unites with the Paraná, to form the Río de La Plata.

The Uruguay River is approximately 1,100 miles long and has many islands in its course. From above Bella Unión its clear waters from the entire boundary between Uruguay and Argentina. The presence of petrified animal and vegetable life in this river and some of its tributaries indicates the presence of petrifying elements in the water.

Annual freshets occur in September or October causing a rise in the river of about 20 feet, and in seasons of excessive rainfall its waters reach a maximum of 40 feet above low water. On the lower reaches of the river the west bank is low and periodically flooded, whereas the steep cliffs and bluffs on the opposite side rise well above the highest inundations and are here and there crowned with picturesque clumps of trees.

Climate and Vegetation

The basin is favorably located and has a mild healthful climate. For the whole basin the average annual temperature ranges from about 36° to 100° F. An occasional abrupt drop to below freezing does occur, however, during the winter for a short period of time. The intense summer heat is tempered by breezes from the Atlantic Ocean.

An abundance of rainfall is well distributed throughout the year, with no prolonged rainy or dry seasons such as mark the more tropical regions of the hemisphere. The annual rainfall averages about 38 inches in the south and about 50 inches in the northern part of the basin.

Vegetation on the broad undulating alluvial plains and adjacent hills affords a luxuriant natural pasturage in the form of tall prairie grass, referred to as the Paraná-Uruguay type. This type bears a close relationship to that of the Pampa farther south, but Uruguay's warmer climate favors a more luxuriant growth. A coarse heavy-texture marsh grass is found near the river in the west-central portion of the basin. Blue and purple plants, spreading over the fertile valleys, have earned for Uruguay the name "Purple Land." In the mountain areas there is a mixed forest growth, and strips of tree growth follow the watercourses; otherwise, the basin has few forests of any kind.

Population

The Uruguay River Basin has no large unsettled areas. The population, thinly distributed throughout the basin, with the heaviest concentration in and around the river ports, is

(Continued on page 117)

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Agriculture in the Americas

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NAMES & NEWS

Returns to Costa Rica

Following conferences during the past several months with officials in Washington, *Dr. Ernest P. Imle*, of the Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, has returned to Costa Rica, where he is working with the Cooperative Experimental Rubber Program which is being carried on by the United States and certain tropical Latin American countries.

●

Mexican Parasitologist To Carry on Research Here

Dr. Eduardo Caballero y Caballero, prominent Mexican parasitologist, has come to the United States on behalf of his government to carry on research at the Beltsville Research Center and at the Smithsonian Institution. Dr. Caballero is Professor of Science at the National University in Mexico City and is also associated with the *Instituto de Biología*.

●

Authority on Tropical Diseases Is U. S. Visitor

Dr. Henrique da Rocha Lima, Director of the Biological Research Institute, São Paulo, Brazil, recently visited the United States to confer with leaders in agricultural, micro-biological, and pathological research. Dr. Rocha Lima has an international reputation in the field of tropical medicine and has been responsible for much research in exanthematic typhus, yellow fever, and other tropical diseases.

●

Colombian Cattleman Is Visitor to U. S.

Sr. Santiago Veraga, prominent Colombian cattleman, is spending some time in the United States investigating the application of insecticides and fungicides and the uses of agricultural machinery.

Dr. Rands Visiting Cooperative Rubber Projects

Dr. Robert D. Rands, Principal Pathologist, Rubber Plant Investigations, of the Bureau of Plant Industry, Soils, and Agricultural Engineering, is on an inspection and conference trip to cooperative rubber investigations projects in Brazil, Peru, and Costa Rica. These projects are part of a program for the development of a permanent self-sustaining rubber-producing industry which is being carried on between the Ministries of Agriculture of 12 tropical American countries and the U. S. Department of Agriculture. Dr. Rands expects to return to the United States about the end of July.

●

Dr. Frederick L. Wellman Confers in Washington

Dr. Frederick L. Wellman, Senior Pathologist and Assistant Director of *Centro Nacional de Agronomía* of El Salvador, returned to Washington recently to confer with specialists on various crop diseases and to work on a treatise on the subject of tropical plant diseases.

●

Assigned to Guatemala

Edward C. Higbee, Agronomist, office of Foreign Agricultural Relations, has been assigned to Guatemala. He will conduct field observations and experimentation on plants producing insecticides, drugs, and essential oils at the *Instituto Agropecuario Nacional*.

●

To Make Special Studies

Dr. Federico Rangel, President of the *Companhia de Expansão Econômica Fluminense*, of Rio de Janeiro, Brazil, is making a special study of economic and agricultural development and the distribution of electric power in the United States.

●

Returns to Colombia

John C. A. Cady, Agricultural Attaché to Colombia, has returned to Bogotá after conferring with officials in Washington in connection with the technical cooperation in agriculture between this government and that of Colombia.

Agriculture IN THE *Americas*

Vol. V. . JULY 1945 . *No. 7*

The Leaf-Cutting Ant Problem In the Americas

Among the most destructive agricultural pests are the leaf-cutting ants, which thrive in many agricultural areas of tropical and sub-tropical America. The control of these ants involves many problems, but it can be accomplished by cooperative community effort.

by EDSON J. HAMBLETON

Long before the early explorers opened the way to Western civilization, leaf-cutting ants had been actively engaged in conducting a specialized type of agriculture. Having already established for themselves among the social insects a place that ranks only second to that of the industrious honeybee, these agricultural ants have survived through the ages, adjusting their way of living to meet the stiff opposition of man.

To the agriculturist today throughout most of the productive areas in tropical and sub-tropical America these leaf-cutting ants are still considered one of the most destructive of all agricultural pests. They are conspicuous among the many species of ants known to inhabit these areas on account of their size and number, the nature of their damage, and the manner in which their immense underground nests are constructed. Few productive agricultural areas, except those at high altitudes, are entirely free from one or more species belonging to the genus *Atta,* the ants which cut and carry off the leaves of many kinds of plants. One may encounter them in the heavy rain forest as well as in open pastures, in cultivated fields, or in one's own back yard. Preference to soil types may be indicative of certain species, but on the whole this factor is of no great importance in their ability to survive. In fact, these ants often utilize underground obstructions such as roots and rocks as an aid in constructing their nests.

Peculiar Feeding Habits

Unlike many of the insect species possessing mandibulate or chewing mouth-parts, leaf-cutting ants do not feed on

Courtesy of *Nature Magazine,* Washington, D. C.

Two leaf-cutting ants use their powerful jaws to carry the banners homeward.

The author lived 10 years in Brazil, as a research worker on cotton pests at the *Instituto Biologico,* São Paulo, and as Professor of Entomology in the *Escola Superior de Agricultura* at Viçosa, Minas Gerais. He also spent 3 years in Peru, working on cotton insects. Since 1943 Mr. Hambleton has been Entomologist in the Office of Foreign Agricultural Relations.

Ant nest, showing loose earth and entrances, near the edge of a large colony.

the huge quantities of vegetable matter which they remove from the forest or from man's diversified crops. This vegetative material in the form of green foliage, fruit, or seeds is carried into the nest, where it is carefully inspected and then ground into a pulp to serve as a medium upon which the fungus *Rozites gongylophora* is cultivated. This fungus is the only food consumed by the larvae and mature ants. Other destructive insects depend upon limited or specific hosts from which their food requirements must be obtained directly. The leaf-cutting ant, on the other hand, can utilize almost any type of vegetation, cutting out pieces of leaves and carrying them off, held perpendicularly above their heads, to the nest.

Before man's intervention in the Tropics leaf-cutting ants flourished on the rich native flora. As this gradually gave way to cultivation, new varieties of food plants were introduced, and with them many changes in the ecological status of the region were brought about. For some insects life became more difficult. Others like the ant were able to adapt themselves to the changed conditions and prospered. New plant resources, perhaps even more appropriate to their needs than the former ones, were made available. In fact, nothing seems to have interfered with their ability to propagate, judging from present-day infestations in those areas where they continue to serve as a constant menace to agricultural progress.

Nests Show Remarkable Engineering

The nest which the leaf-cutting ant excavates is a remarkable feat of engineering skill. During the early rainy season the queen ant establishes her young colony. First she excavates a small earthen cell approximately the size of a hen's egg, in which she deposits a number of eggs. From 40 to 60 days later small nurse ants, developed from these eggs, appear on the scene to relieve her of the duty of caring for the precious fungus carried by her from the parent colony. As the fungus garden increases in size and more eggs are deposited, other castes are developed. Worker ants begin the excavation of new galleries, the original cell made by the queen is enlarged or larger ones are substituted, and a new entrance to the colony is prepared. In the meantime new castes of worker ants engage in labor outside the nest. In 10 months a second opening to the nest is made, and from then on the colony develops rapidly. At the end of 3 years the nest has reached enormous proportions, and as many as 300 active fungus gardens, each the size of a small football, may be found. In each one are the sponge-like fungus, hundreds of mature ants, and larvae and pupae of all sizes. Numerous galleries of different sizes ramify throughout the area occupied by the fungus gardens and connect with others which form the highways offering passageway to and from the nest.

These huge complicated subterranean structures are excavated with the utmost care and precaution, no detail being overlooked by the ants to provide uniform conditions of temperature and moisture throughout the year. Insofar as these two factors are concerned, growth conditions are essentially the same for the ants in their immature stages as for the fungus which they cultivate and utilize as food.

In self defense, the ant colony fortifies itself well against all intruders whether they be man or lower animal. The nests of some species often reach the depth of 20 feet or more and occupy many cubic yards of soil. Such a natural barrier is not easily overcome by the enemies of the ant. The natural protection afforded the ant colony is further strengthened by the presence of a soldier caste whose members are provided with powerful mandibles, or jaws, capable of inflicting severe bites. These large ants stand guard, prepared at a moment's notice to issue forth from any entrance to the colony when once molested.

A leaf-cutting ant in the act of cutting off a second portion of a leaf of the kenaf fiber plant.

As a rule, nests located within woodlands do not possess many long subterranean galleries, because the working caste, whose duty it is to assemble plant material, takes advantage of the natural cover of the forest and makes its runways beneath the vegetation on the surface of the soil. Nests constructed in the open, or where little or no cover is provided, are further safeguarded by the presence of long underground galleries radiating several hundred feet from the nest to various sources of plant growth. The species *Atta cephalotes,* which inhabits many of the heavy-rainfall areas, constructs a more superficial nest in order to avoid inundation.

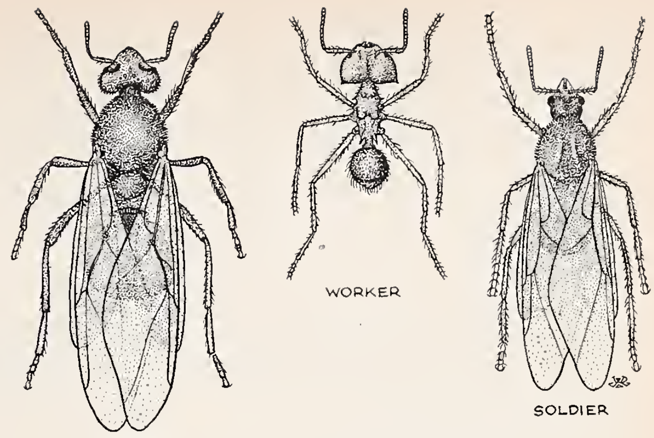
Methods of Fighting These Pests

Of all such facts man should be mindful while contending not only with the leaf-cutting ant but with other harmful insects whose habits and means of defense are so well organized. He must necessarily plan intelligently to overcome the opposition that has been established for many centuries. The very nature of its social organization, with the division of labor and duties of each caste so well differentiated, is one reason why this particular species of ant has succeeded in maintaining itself in spite of man's comparatively recent attempt to reduce the losses it causes in the field.

Numerous methods devised for the destruction of leaf-cutting ants and their nests range from digging them out by hand to fumigation by means of poison gases injected into the nest through natural or artificial openings. By far the most economical and effective method is the application of poison gases. Carbon bisulfide is one of the best-known materials for this purpose. Sulfur and white arsenic when burned and applied in a specially adapted apparatus have been used also with much success. Methyl bromide has proved effective and practical in controlling the ant in Texas. But regardless of the method used, the grower must be familiar with the habits of the ant and possess a knowledge of its nest in order to apply his chemical ingredients successfully. Too many cases of failure have resulted from lack of this information.

Problems of Control

With the outbreak of war and the resulting interest in the development of new tropical crops for the Americas, considerable attention has been given to the problems in connection with the control of leaf-cutting ants, especially in those areas where strategic crops are under cultivation. The problems involved vary in each country according to its topography, the nature of its agriculture, and transportation facilities. The availability and cost of insecticides and the presence or absence of trained personnel are factors that more than often tend to discourage those of low income whose means do not permit the necessary expenditures for fighting insect pests.



Unfortunately many of the mechanical devices developed for burning sulfur and arsenic are expensive and, on account of their weight and make-up, require additional skill in their manipulation. Many are actually impractical and burdensome to transport. Some effort is being made to develop a less expensive, more practical type of apparatus in the hope that this may stimulate a further interest in combatting ants. In some countries sulfur and arsenic are readily available while in others they must be imported, and the high retail prices of these chemicals usually prohibit their use on a wide scale.

On the larger *finca* or *hacienda* where more extensive crops like coffee, sugarcane, or bananas are grown, or even where livestock production is the chief source of income, financial difficulties seldom concern the grower to such an extent that he is unable to finance a control program. Large tracts of privately owned land also require greater surveillance, and only through constant supervision may leaf-cutting ants be kept under control. One of the greatest difficulties, however, lies with the small landholder, who is financially unable to cope with his own problem, or who for lack of technical advice has failed to control ants successfully and has assumed an indifferent attitude toward the problem. This spirit often prevails in a community and frequently results in great damage.

In intensively cultivated areas control of the leaf-cutting ant should not be so serious a problem as one might expect. Many of these areas are divided into small holdings, made accessible by modern transportation facilities; much of the land is cultivated, and crop rotation is quite generally practiced. Here, too, the population is large enough to make ample hand labor available. Although physical conditions of the landscape may decidedly favor ant propagation, there is every reason to believe that control of the pest is less laborious and far more satisfactory in intensively cultivated areas than in scattered communities.

In wooded areas ants are sometimes numerous enough to overrun small clearings and cause wholesale destruction if

(Continued on page 135)

Courtesy of Pan American Union

Lake in the Clouds

Lying on the Altiplano of Bolivia and Peru, more than 12,000 feet above sea level, is beautiful Lake Titicaca. Rich in archeological ruins of early Inca civilization, it is today a point of great interest to travelers in South America.

by BEATRICE DU FRANE

Of the many points of interest to the scientist and traveler in the Western Hemisphere, one of the most intriguing is beautiful Lake Titicaca, which lies at an elevation of more than 12,000 feet above sea level and upon whose cold blue waters modern-day steamboats and picturesque but serviceable *balsas,* or reed boats, of the natives ply side by side.

The lake lies partly in Bolivia and partly in Peru, the International boundary passing through its center. From time immemorial Lake Titicaca has played a fascinating role in the lives of the people who have lived along its shores. According to legend it was here that the Incas first established themselves on the earth. Much archeological evidence remains to show that a proud and once-powerful civilization existed in the region many centuries ago.

Makes Impressive Picture

To the eye of the visitor Lake Titicaca presents an impressive picture. Not only is it one of the highest navigable bodies of water in the world but it is paralleled on one side by snow-capped mountain peaks, many of which rise to a height of nearly 2 miles above the lake's surface. The

lake measures 138 miles in length, 69 miles in width, and covers approximately 4,000 square miles. Maximum depth is about 900 feet, which helps to maintain a nearly constant lake temperature of about 51° F. throughout the year. On the other hand is some parts of the lake, such as Puno Bay and Lago Pequeño, the water is less than 7 feet deep and is filled in by *totora* or cattail swamps. Ice forms only in the most shallow places along the shoreline. In the southern part of the lake two peninsulas, Copacabana on the west and Huata or Achacachi on the east, almost cut the lake in two, leaving only the narrow Strait of Tiquina. Not far from the peninsulas lie 8 large islands, two of which, the Island of the Sun and the Island of the Moon, were held sacred by the Incas.

Broken by numerous tiny bays with sandy shores and shelving heads, the shoreline is extremely irregular and for the most part steep and characterized by barren, rocky hills that rise nearly 2,000 feet above the lake. Extensive plains border the lake at the southern tip of Lago Pequeño and at the mouths of the larger rivers. Because of the great altitude no trees grow naturally along the lake shore although reeds or bulrushes and lake-weed thrive there. From the reeds the Indians build canoe-like boats or *balsas* and from the lake-weeds their herds obtain feed in season.

The *balsas* provide the lake with one of its most picturesque features. These unusual boats are made from the dried reeds, securely lashed together to form the hulls and turned up at the ends. Sails for the *balsas* are also made from the dried reeds. Many of the *balsas* are capable of transporting livestock as well as passengers but even the strongest remain serviceable for only about 6 months. After that time they become waterlogged and must be abandoned.

Lake Titicaca lies within the high plateau region of Bolivia and Peru. This region, which is known as the Altiplano, is divided into three basins: the Uyuni salt pans, the Poopó Basin, and the northern basin, in which Lake Titicaca is located. The average elevation of the Altiplano is approximately 12,000 feet with mountain peaks to the northeast that reach a height of more than 20,000 feet. Mountain ranges separate it from the eastern part of Bolivia, and from much of Peru on the west. Scientists believe that many thousands of years ago, during the Pleistocene period, Lake Titicaca and nearby Lake Poopó formed one large body of water, known as Lake Ballivian. It is thought that this ancient body of water was formed by melting glacial ice fields.

Area Drained

An area of a little more than 16,000 square miles is drained by Lake Titicaca. For the most part the lake receives its waters from several rivers although indirectly it is fed by a number of lakes, tarns, and small streams, some of which are permanent and others seasonal. The permanant streams are also employed for irrigation, and for this reason not much water from this source reaches the lake during the dry season. Although the western drainage area is larger, Lake Titicaca probably receives the greater share of its water from the melting snows of the Cordillera to the east and north.

The Río Desaguardero, located at the southern tip of Lake Titicaca, serves as an outlet. The fresh water of the lake empties into the river during the rainy season at the rate of about 6,000 cubic feet per second, dwindling to about 700 cubic feet during the dry season. The Río Desaguardero is a little over 200 miles in length and connects Lake Titicaca with Lake Poopó. On its journey southward the river flows over saline beds from which a certain amount of salt is carried away in solution. As a result of this, Lake Poopó is quite salty.

Over the northern part of the lake the rainfall averages between 20 and 30 inches annually, about 70 percent of which falls from December to March, during the rainy season. Only about 5 percent falls during the dry season, from May to August. Over the southern portion of the lake indications point to a somewhat greater annual rainfall, due probably to the nearness of the Cordillera Real. Because the heaviest precipitation over Lake Titicaca takes place during the summer, drainage into the lake is greatest

Courtesy of Pan American Union

***Balsas*, or reed boats, are attractive features of Lake Titicaca.**

from January to March. The level of the lake fluctuates because of the concentration of rainfall in this one season, reaching its highest point early in April and dropping to its lowest level in December.

There is considerable evidence that the water level of Lake Titicaca is slowly falling. The plains along its shores are said to owe their existence to the gradual recession of the waters and to the accumulation of silt brought into the area by the rivers. Records tell of strife over new land thus brought into existence by the receding waters. A number of Indian villages, such as Achacachi, Ancoraimes, and Huarina, are believed to have stood on the lake shores at one time although now they are 2 miles inland.

Farming is carried on along the shores of Lake Titicaca. This scene, near Guatahata on the north shore of the lake, shows ground being broken for barley. Women, dressed in black homespun, drop the seed.

Agriculture

A number of factors prevent the extensive development of agriculture in the Titicaca Basin. Because of the high altitude and low temperatures few plants flourish in the region. Agriculture is further discouraged by the fact that the Indians spend much time in mining, which is the chief industry of the Altiplano. As a result, much of the food consumed in the region of Lake Titicaca must be imported.

In spite of these conditions small fields are worked along the lake shores, in the more level areas, and in the valleys where irrigation is possible. The Indians depend almost entirely upon barley and potatoes. *Quinua* (*Chenopodium quinoa*) and *cañagua* (*Chenopodium canahua*), which resemble and are somewhat related to the weed, lamb's quarters, serve as a food and as an ingredient in the drink *chicha*. Medicinal remedies are obtained from arnica, valerian, and other plants which grow in the highlands. Livestock consist primarily of the alpaca and the llama although a few of the natives own oxen, burros, and sheep. In the late 1930's Lake Titicaca was heavily stocked with rainbow trout, which provide food for the natives.

Cities

A number of important cities are located in the Titicaca Basin, one of the most important of which is Guaqui. Located near the mouth of the Río Desaguadero, it is the principal lake port of Bolivia and is visited by steamers from Puno and other points on Lake Titicaca. Puerto Acosta is one of the chief ports on the northern end of the lake. Puno, on the Peruvian side of Lake Titicaca, was built by the Inca leader, Hatun Kollao, and is rich in archeological treasures.

Perhaps the most interesting city of all is Copacabana, located on the peninsula of the same name in the southeastern end of the lake. Copacabana, which means "Beholder of the Sacred Stone", held a significant place in the religious life of the Incas long before the Spaniards brought Christianity into the New World. It was founded by the Inca leader, Tupac Yupanqui, and here in ancient times the Indians gathered to make pilgrimages to the sacred Island of the Sun.

Today, each year a colorful pageant of the miraculous Virgin of Copacabana is held in August and is attended by Indians from all parts of the region. The pilgrimage reaches its climax in religious festivals during which the Indians appeal to the Virgin for livestock, fruitful crops, and health.

Legends and Ruins

Few regions in the world are more replete with legendary lore or have more ruins of early civilizations than the Titicaca Basin. Of foremost interest are the ruins on the sacred islands, Intikarka, or *Isla del Sol,* and Coati, *Isla de la Luna*—the Island of the Sun and the Island of the Moon. Intikarka is closely associated with the legend concerning the establishment of the Inca Empire. According to the legend the first of the Incas were named Manco Capac and Mama Oclla and they were children of the sun. They made their appearance on earth on the Island of the Sun. Manco Capac and Mama Oclla, the story goes, were given a golden rod and sent forth to found the Inca Empire. They were told to find a location where the rod would pierce the earth without difficulty. Their quest ended at the present site of Cuzco and here they founded the Empire that eventually was to cover more than 1,200,000 square miles and include a population of 20 million persons.

Of perhaps even greater interest than the ruins of the Incas are those of Tiahuanaco. The ruins of this ancient village stand about 13 miles from the lower end of Lake Titicaca in Bolivia but traces of a dock to the north of the main ruin indicate that it stood at one time either on the shores of the lake or on some arm or estuary of it. Although the mystery of Tiahuanaco has never been fully solved, archeologists believe that the ruins represent two civilizations, the first of which must have existed more than 6,000 years ago. Giant monoliths and statues and portions of well-constructed buildings with exquisite carvings testify that this was the capital of a highly developed people. It is believed that the last residents of Tiahuanaco disappeared hundreds of years before the fall of the Roman Empire.

Civilizations have come and gone but Titicaca, "Lake of the Clouds," serves them all. As in centuries past, it continues to play an important part in the material and religious life of those who live close to its historic waters.

The author is a member of the staff of the Office of Foreign Agricultural Relations.

South Brazil's Cotton Boom

Cotton is one of the most important of the world's agricultural products. In recent years Southern Brazil has been producing a substantial amount of this commodity. The author tells how cotton is grown, handled, and marketed in São Paulo.

by HENRY W. SPIELMAN

The development of cotton production in South Brazil has been faster than in any other major cotton-producing region in the world. During the 5-year period ending in 1930 the average production in this section was slightly over 40,000 bales a year. In 1944 the crop was more than 2,145,000 bales. In the United States only Texas exceeded this quantity. In the 1943-44 season, total Brazilian production amounted to 2,675,000 bales, or 23 percent of the United States production for that season.

In Brazil there are two distinct zones of cotton production. The northern, including six northeastern States, and the southern, in which are included the States of São Paulo, Paraná, Minas Gerais, Rio de Janeiro, Espirito Santo, and southern Baía. Of all the Brazilian States São Paulo is the leading cotton producer, growing about three times the total of the others. In this State the area planted to cotton is nearly twice that of all other cotton-producing States combined, and the yield, averaging 200 pounds of lint cotton per acre, is higher than that of any other State, although it exceeds the yield of Paraná only slightly.

Producing Cotton in São Paulo

In several respects the cotton-producing region of São Paulo somewhat resembles that of Mississippi, though accurate comparisons would be difficult between two regions so widely separated. São Paulo has no large level areas such as the productive Mississippi delta, but in the old coffee zones, an area of rolling topography, the soil is red clay and exceedingly productive. In the western third of the State are sandy soils which, after being farmed for several years, resemble the rolling hills of Mississippi. Judging by the original vegetation, which in São Paulo was deciduous and semi-deciduous forest, the native fertility of these sandy soils was somewhat higher than similar soils in Mississippi, where the native vegetation was pine. After 5 or 6 years of continuous row cultivation, however, the São Paulo soils lose their productivity and have to be treated in much the same manner as the sandy soils of the cotton growing areas of the Southern United States. Two-thirds of the cotton produced in São Paulo is raised on the sandy soils of this western third of the State.

More than two-thirds of the cotton land is farmed by Brazilians, a little more than a sixth by Japanese, and small percentages by Italians and Spanish. Many of the Brazilians came from Minas Gerais, Baía, Pernambuco, and other States when the new cotton area was opened in São Paulo. Over 42 percent of the cotton farms are operated by share tenants. Equipment, houses, maintenance, and credit are furnished them during the growing season, and these advances are paid out of their share of the crop.

Brazilian cotton pickers usually use baskets or gasoline cans to collect their seed cotton.

Much of the cotton land in São Paulo has only recently been cleared for agricultural purposes. In clearing land, the cutting is done from May to July, during the dry period. After the cut brush and trees have dried about a month, they are burned, usually during August. Smoke from these fires drifts 300 to 500 miles, frequently dimming the sun in the cities of São Paulo and Rio de Janeiro.

Mr. Spielman is Agricultural Economist in the Office of the United States Consulate General, São Paulo, Brazil.

In well-lighted warehouses, cotton is classified by government representatives and reviewed by the chairman of the Cotton Classification Board.

Although fertilizers are probably needed on all but the newest soils, they are used only in the old cotton-producing zones. Super-phosphate, bonemeal, precipitated calcium phosphate, and two national phosphates are the principal fertilizers used. Some animal-drawn equipment is employed, but most of the fertilizer is distributed by hand.

In the new zones no plowing is done, but in the eastern growing region of the State, where the land is free of stumps and logs, the farmer plows his land after the first spring rains, late in August or early in September. He does most of it with one or two mules, though in the older sections two, three, or four oxen are often used.

Planting begins the last of September and continues to the first of December, with October the best month. About 90 percent of the cotton is planted by hand. Two men work together, one making the holes, usually with his foot, about one step apart, the other dropping the seed and covering them. Even when shallow furrows are used instead of holes, the seed are still dropped by hand.

All planting seed has been developed by the central experiment station and distributed by the State Secretariat of Agriculture. During the 1944-45 season three strains or varieties were distributed, two being developed from the United States variety Texas and one from Express. A law provides that no grower may use his own seed or buy it from a ginner but must buy it from the State agency.

Just as cotton is planted by hand, it must also be thinned by hand, usually three or four plants being left in each hill. Most cultivating is done by hand with a hoe. If done mechanically, a one-row walking cultivator is generally used. Cotton is cultivated three or four times a year, depending upon the amount of rain and the rate of growth of grass and weeds. A practice commonly used at present in the new zones is to cut the terminal bud when the plant is about 4 feet high. This stops the growth of the plant and forces it to put on fruit.

Harvesting begins late in March and continues through May, June, or July, depending upon the weather. Three pickings are generally made, although in areas of heavy production as many as six may be necessary. As in other cotton-producing countries, cotton is picked by men, women, and children, who sometimes have small sacks tied around their waists to receive the cotton. In areas where yields range from 220 to 330 pounds of lint an acre, one worker can pick 100 to 130 pounds of seed cotton a day, but 65 to 80 pounds is more common. Most cotton is put into baskets, buckets, or gasoline cans placed near the pickers, and much time is lost in carrying the cotton to these containers.

Handling

Almost every method is used for transporting cotton. It goes to the gin by ox cart, wagon, truck, or railroad. From the gin to the warehouse, compress or port cotton is hauled by rail. Before the gasoline shortage some baled cotton was hauled by truck.

With few exceptions, cotton gins in São Paulo were manufactured in the United States and have been installed within the past 10 or 11 years. They are, therefore, on an average, more modern than gins in the United States. The annual average of ginning for São Paulo is 4,412 bales per gin as compared with 1,154 in the United States. The gins have three, four, or five gin stands each. A few gin buildings house double batteries but for statistical purposes these are considered two gins. Practically all of them operate 24 hours a day from April through July. Most of them are finished by the last of November, though some operate during the entire year. A number have high-density presses so that cotton for export does not have to be re-pressed before it is exported.

All cotton bales are required by law to be wrapped in white cotton bagging with a green and yellow stripe, the national colors, through the center. Regular gin bales are tied with six or seven bands, and gin-compressed bales with nine to eleven. The Brazilian bale is somewhat smaller than the United States bale. It is stamped with the name and address of the gin, the gin bale number and weight in kilos, and the notice of the inspection by a representative of the State Secretariat of Agriculture.

All lint cotton is required by law to be classified by an employee of the Federal Government, who takes a sample from each bale at the gin and mails it immediately to the classifying office in the city of São Paulo. There are 13 grade standards. Type 5 is the middle grade and is about equal to the United States grade of middling, although in some seasons it contains a light spot. The staple length, which is determined in millimeters, is about equal to from 31/32 to 1 1/32 inches.

Marketing

Growers sell their cotton with the seed in it to ginners, local merchants, and truck drivers, usually to a buyer who

has financed them. Only a few large growers have their cotton custom-ginned and sell it as baled lint cotton.

About a third of the total is bought by independent ginners, who in turn sell their baled cotton through brokers in the city of São Paulo, or directly to exporters. Brokers sell directly to local mills or to export merchants. Ginners handling the other two-thirds, like line ginners in the United States, are mostly agents for export merchants, selling through their own cotton departments.

Practically all the cotton sold by brokers is sold on the government classification certificates of grade, and in general this is considered a satisfactory basis for purchasing. Export merchants accept these certificates, and all Brazilian mill operators are required by law to buy cotton on this basis. As few of them have their own classing departments, mills use the government classification in preparing lots for spinning purposes.

Brazilian exporters sell directly to foreign mills, through brokers, through their own cotton departments, or to foreign importers. They are the most important single influence in the São Paulo market.

The São Paulo spot market is the most active one for baled cotton in Brazil. The cotton exchange regulates trading in spot cotton as well as futures and issues regularly quotations for both spot and future sales. In 1943 over a million and a half bales of cotton were handled by the futures market.

In 1939, the last year before the war disrupted international trade, about 95 percent of São Paulo cotton produced that year was exported. Consumption was drawn from carry-over stocks. Japan took 28 percent of the exports; China, Germany, England, and France took most of the remaining. In recent years England, Sweden, Spain, and Colombia have taken a large share of the exports, although the total has been much smaller than prior to the war.

Domestic consumption has more than doubled during the last 5 years. A third of the spindles of the country are in the State of São Paulo, where mill consumption in 1944 was nearly 370,000 bales, the largest amount on record.

Government Policy

A large part of the credit for the phenomenal growth of cotton production in the State must go to the government seed breeders. They worked systematically and continuously for over 8 years before suitable varieties adapted to local conditions were developed. One of the leaders in this work was Dr. Cruz Martins, who also helped establish a system for distributing pure disease-free seed so that growers would get full benefit of the work done by the State experiment station and would aid in improving the uniformity of staple length and character of the fiber produced throughout the State. The effectiveness of that work is evidenced by the popularity of São Paulo cotton among the exacting English spinners, who use it equally with Texas bread-and-butter cotton.

The system of State distribution of all seed used for planting was started in 1930 but was not required until the 1935-36 season. The State is divided into 14 districts with a graduate of the State Agricultural College in charge of each district seed office. Seed is sold for about $2.00 a bag of 66 pounds. The grower is given the right to buy insecticides at reduced prices when he presents his seed-purchase receipt by the State and his crops are insured by the State against hail damage.

Inspectors employed by the Secretariat of Agriculture constantly supervise the operations of the cotton gins and warehouses, sampling and classifying every bale of cotton ginned in the State. This classification service was organized 10 years ago under the direction of José Garbaldi Dantas and it has improved steadily since that time under his direction.

In recent years the Government has taken steps to support cotton prices through loans to holders of cotton who, for the most part, are ginners. The loan rate was equivalent to about $.0583 per pound in February 1941, when the

(Continued on page 138)

Courtesy of *Bolsa de Mercadoria de São Paulo*

Brazilian cotton bales are considerably smaller than those in the United States.

Bay Rum From Puerto Rico

The soothing quality of bay rum makes it a favorite lotion, but comparatively few people know where or how the essential ingredient of bay rum is obtained. From Puerto Rico comes this account of the industry on that island.

by **N. F. CHILDERS** *and* **P. SEGUINOT ROBLES**

Bay rum is a well-known lotion, found commonly on drug counters and in barber shops. The solvent is ethyl alcohol, and the essential ingredient is about 1 percent bay oil, which accounts for the characteristic odor of the lotion. Bay rum is soothing to the skin and is considered to have some healing qualities which are due to the antiseptic action of the phenols of the oil. The essential oil itself is distilled from the leaves of the bay-rum tree, *Pimenta racemosa* (Mill.) Moore, not to be confused with the true-bay tree, which is a laurel. The bay-rum tree is indigenous to the West Indies and now can be found growing in many of the neighboring Latin American countries. In addition, several other varieties of bay have been described, including one known as lemonscented or *limoncillo,* which are not desirable for market.

Bay-rum trees are kept at uniform height for many years by removing tops of the uppermost limbs during harvest. This 12-year-old tree is maintained at a height of 12 feet.

In Puerto Rico the bay-rum industry is limited to a few scattered growers in the central and southern sections of the island, mainly in the southeast. The exports of bay oil and bay rum, practically all of which go to the United States, have varied annually between 2,000 and 25,000 pounds of bay oil and 4,000 and 16,000 gallons of bay rum. The annual value of these products, according to the Department of Agriculture and Commerce of Puerto Rico, has ranged in recent years from $20,000 to $30,000. This does not include the amount that is consumed locally on the island. In 1939 the price of the oil was $2.50, in 1941 it was 80 cents, and at present it is about $1.40 a pound. The amount of bay oil the market can absorb is limited. Overproduction would, therefore, be quite possible, unless a definite sales program were initiated to increase consumption and promote other uses of the oil, such as flavoring for sauces and using the extracted eugenol in carnation perfumes.

The bay-rum tree has several advantages as a crop. It can be grown on steep rocky hillsides where the production of other crops would be difficult or impossible. The trees need little attention, although, no doubt, they would respond favorably to an improved cultural program, and a plantation will last about 50 years with little replanting. Furthermore, insects and diseases are of minor concern. This industry is particularly useful in a diversified-crop program because the harvesting and distillation can be delayed until periods when other work is slack.

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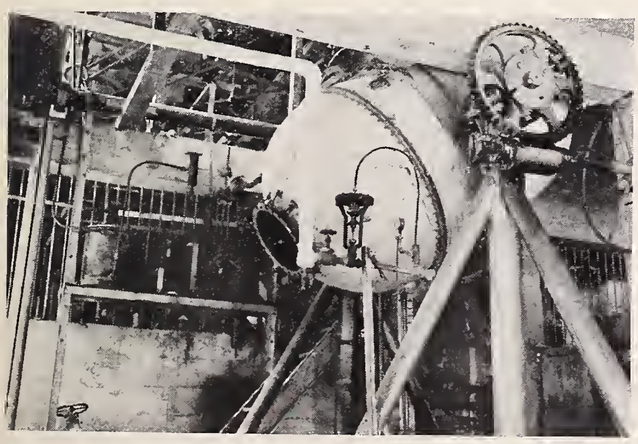
The Tree

Many bay-rum trees are found growing wild in Puerto Rico up to an altitude of about 2,000 feet. The largest tree observed is located near Adjuntas. It has a vase shape similar to that of the American elm and is about 60 feet high with a trunk circumference of 7 feet at breast height. The commercial tree is usually not permitted to attain a height of more than 10 to 15 feet for convenience in harvesting. It is moderately slow in growth, attaining standard height in about 5 to 8 years depending upon soil and moisture conditions. The tree retains its leaves throughout the year. When young, the leaves are light green and pliable, but within a few months they become leathery and dark green, resembling gardenia leaves in many respects. If properly trained, the tree would make a useful ornamental for landscaping purposes.

The characteristics of bay leaves vary considerably from tree to tree because the seedling trees are not genetically uniform. Some leaves are flat, others have rolled-under margins. Some are small, others large, and the leaves of an occasional tree have an over-all grayish cast. The oil content of leaves of the different seedlings also varies. The extent of this variation is now under study at the Mayagüez Experiment Station.

The bay-rum tree flowers in March and April, and the small berry-like fruits are harvested in August and September. Since the seed are somewhat difficult to germinate, some growers have resorted to transplanting voluntary seedlings appearing in established plantings. Other growers report about 50-percent germination by washing the seed and planting them immediately a quarter of an inch deep in a well-prepared seedbed shaded from direct sun. Experience in the Mayagüez laboratory has shown that as high as 98-percent germination can be secured by placing the seed on damp filter paper in petri dishes—small shallow dishes of thin glass with loosely fitting over-lapping covers. These tests indicate that seed should be sown soon after the drupes, or stone-fruits, are removed from the tree and immediately after removal of the seed from the ripened drupes. If the seed was not planted until 3 days after removal from the drupes, the germination dropped to 65 percent.



Bay-leaf distillery near Ponce, Puerto Rico. The vat, through which bay leaves are distilled, is shown in discharging position. In right foreground are steam pipe and pressure valve; in center rear are the final oil-collection chambers.

Bay-rum trees usually are planted on hilly, sometimes rocky, land which is not adapted to other crops. This section of a 110-acre planting is located near Utuado in the central-western section of Puerto Rico.

In field practice the small seedlings are placed 3 inches apart in a shaded bed and when 3 to 4 inches high are transplanted to larger beds. Plants are spaced 6 inches apart. A good location for these beds is near a stream on a north slope where irrigation water is available and where they are protected from direct rays of the sun. After 1 year of growth the taproot is severed 6 inches below the ground to induce more fibrous lateral roots. The seedlings are usually ready for transplanting to the field after a year and a half to 2 years in the nursery. The seedlings vary widely in type and vigor and only the sturdy plants should be used. In Puerto Rico transplanting is done preferably at the beginning of the rainy season in May or June.

The bay-rum tree grows on a variety of soils but the better trees are found on soils high in organic matter, medium to medium heavy in texture, and well drained. On rocky hillsides an occasional tree may be found growing poorly. This may be due to limited rooting area because of under-

lying rock. In such plantings special precaution is necessary to sidestep these shallow-soil spots. The tree should have at least a 3-foot rooting depth. Trees are usually planted at the corners of rectangles about 5 by 8 feet.

In recent years some growers have used individual circular terraces about 5 feet in diameter for each tree. The chief advantage of such terraces is that they tend to collect and conserve moisture and control soil erosion. Twice a year the voluntary plant growth is cut and mulched about the trees.

Fertilization of bay-rum trees is not a general practice in Puerto Rico, although they would probably respond to annual applications of a complete fertilizer, especially nitrogen, which would tend to increase vegetative growth. The effect which this would have on the oil content of the leaves or on the frequency of harvests is not known. One grower in Puerto Rico applied three-quarters of a pound per tree of a 10-6-16 fertilizer in April and doubled the total leaf production the following year without noticeably affecting the oil content of the leaves. There was, however, no definite check plot to prove that the increased production was due entirely to fertilizer and not in part to weather conditions or other factors.

There is a wide variation among seedlings in character and vigor of growth. The four plants on the right are considered "runts", or mal-shaped, and will be discarded. Note complete change of leaf type in the two center plants. The two seedlings on the left are ready for transplanting, after which about one-third of the tops will be removed.

Harvesting the Leaves

The time of harvesting the leaves varies, depending upon the urgency of duties with other crops and upon the rate of leaf development, which is affected by many factors such as soil type and fertility, moisture, and cultural care. Intervals between harvests may extend from 9 months to 2 years, but, if leaves are left longer than 2 years, they tend to abscise, or drop off, especially during the dry season. Eighteen months is considered about an average harvest interval in Puerto Rico. An attempt is made to harvest most of the leaves in the winter season, but some growers harvest at odd times throughout the year. Experience in Puerto Rico and in Montserrat, as reported in No. 15 of the 1915 *West Indian Bulletin,* indicates that the oil content runs slightly lower during the rainy season.

Two methods of harvesting are employed. In one method, leaves are stripped from the trees, few limbs or shoots being removed except those at the top, which are pruned to keep the tree low. In the other method, both shoots and leaves are removed and tied in bundles for transportation to the distillery. This "deshooting" method is more convenient and simple than the other and it does keep the tree within bounds and the center free from barren twigs, but the heavy pruning may lengthen harvest intervals and reduce yield per tree. Perhaps a combination of the two systems would be most desirable, removing the longer limbs and only stripping the leaves from the shorter shoots. Yields of fresh leaves per acre may be from 10,000 to 30,000 pounds. The larger growers in Puerto Rico report for their *fincas,* as a whole, around 15,000 pounds an acre. Yields are usually higher for trees planted at the base of hills where moisture and soil conditions are better than on the hillsides.

Processing to Obtain Oil

Leaves are usually held in a bin for about 3 days after harvesting before being processed. This seems to increase the yield of oil and makes easier the handling of the leaves. The leaves are crushed and bruised by passing them through a chopper much like a corn shredder. The chopper is located above the distilling vat so that the crushed leaves fall down a chute directly into the vat, where they are packed moderately. The vat is filled half full of water from a spring or a nearby stream and is sealed. Live steam is then introduced into the vat through a pipe and passes through the leaves and water for about 5 hours, depending upon the size of the still. The resulting vapor, carrying the oil from the leaves, passes into a condensation tank, where the oil is drawn off. Perhaps the name bay rum comes from the fact that bay leaves used to be distilled in rum and water. Most of the oil is released during the first 2 hours of distillation, but that which follows later is higher in phenol content and is more valuable. The authors of an article

entitled "The Use of Salt in Distilling Bay Leaves," in the October 1942 issue of *American Perfumer and Essential Oil Review,* state that salt added to the mixture in the form of sea water or as sodium chloride causes more oil of better quality to be released. Oil yields of 1 to 1.5 percent of the weight of the leaves while fresh are usual, although Ernest J. Parry, in "The Chemistry of Essential Oils and Artificial Perfumes" in Volume I, 1921, of the Monographs on Essential Oils, reports that the yields may be as high as 3.0 percent.

More Research Needed

Little or no experimental data are available on the effect of cultural practices on growth and oil production of bay-rum trees. Research has been confined to the chemistry and distillation phases of the problem. Even the data available deal only with limited problems and are in need of considerable confirmation under different climatic conditions and cultural treatments. Because of the wide variations in vigor, character of growth, and amount and quality of oil among seedlings, a search should be made for superior clones for propagation. When these clones have been found, the need will arise for an effective method of propagation. At present, growers are of the opinion that grafting may be impractical because of the characteristically thin dry bark of the trees. Other problems which are under investigation at the Mayagüez Station are fertilization, terracing, mulching, cover crops, and interval, season, and method of harvest.

Undoubtedly the bay-rum tree has a definite and important place in Puerto Rican agriculture, but an over-production of bay oil has been experienced in the past and is readily possible in the future.

LEAF-CUTTING ANTS

(Continued from page 125)

left unchecked. Cultivated crops growing adjacent to woodlands usually suffer even more loss than those located elsewhere, since the natural protection of the forest serves to shield the leaf-cutting caste from its natural enemies and from the intense heat of day, permitting them to work both day and night if necessary.

Cooperative Effort Needed

Successful ant control in any locality must be conducted on a cooperative community basis. The time and energy expended by a few individuals is often frustrated by the unwillingness on the part of others to share their resources in planning and conducting a control program of benefit to all concerned. Leaders in any community should work through the proper channels to interest government officials and engage their active participation in such a program. Proper leadership, trained personnel, and financial aid are requisites for success in any organization of this nature. A control campaign against leaf-cutting ants should be looked upon as a continuous affair. It should develop slowly, starting with a small organization and increasing in size as the results obtained indicate the local needs.

In the past, growers have had to rely upon their own initiative in solving many of their insect problems. As agricultural progress forges ahead, insect-control problems generally multiply and increase in their complexity. No time should be lost in collecting data on the important species and in seeking aid through agricultural experiment stations or other reliable sources for information as to how ants and other injurious insects may be prevented from causing additional losses.

ALONG THE *Agricultural Front*

▲ Argentina Establishes New Plant Division

The Argentine Government recently created a Division of Plant Exploration and Introduction under the Bureau of Experiment Stations of the Argentine Ministry of Agriculture.

The Ministry of Agriculture feels that the introduction of new species and varieties of useful plants has always been one of the major concerns of the most progressive countries, according to an item in *Informaciones*, a publication of the *Ministerio de Relaciones Exteriores y Culto.*

The functions of the new Division will include the procurement of plant propagating material from domestic and foreign sources. A system of exchange with similar institutions in foreign countries is planned under the program. Stock received would be maintained at various localities throughout the country, to provide acclimatized material for use in diversifying and improving Argentine crops.

The first Division of Plant Exploration and Introduction was established by the U. S. Department of Agriculture a half century ago. A number of other countries have established similar divisions since then.

▲ Serum From Brazilian Snake Farm

Poisonous snakes, toads, spiders, and other insects are among the hazards faced by farmers, by rubber gatherers in the forests of the Amazon, and by workers in newly developed industrial areas. The lives of thousands of tropical workers in essential war needs are being safeguarded by snakebite serums and other vaccines produced through the Butantan Institute, near the city of São Paulo. Interesting information about the work there is available from the C.I.A.A. Through cooperative arrangements with farmers and residents in isolated sections of Brazil the supply of live snakes is kept replenished at the Institute for the preparation of the serums.

▲ Livestock Is Leading Brazilian Resource

Livestock and livestock products are more important in Brazil's economy than coffee and cotton combined, according to a study recently published by the Production Statistics Service of the Brazilian Ministry of Agriculture.

The leading position of coffee in Brazil's export trade has tended to obscure the domestic dominance of other commodities. In fact, the study indicates that a total of five commodities rank above coffee in their over-all monetary value to Brazil's economy. Following livestock and livestock products are cotton, corn, wood, and sugar and its products. The value of firewood, important to the Brazilian as a domestic fuel source in the absence of extensive coal and petroleum extraction, is included in the figure for wood.

This study helps to correct popular misconception arising from the better availability in most countries of facts about foreign trade than of information about the significance of domestic production. The title of the study is *Aspectos da Produçáo de Origem Animal, 1940-42.*

▲ United Nations Food and Agriculture Organization

The United Nations Interim Commission on Food and Agriculture has announced that among the 19 nations which have already accepted the constitution of the Food and Agriculture Organization of the United Nations are 7 of the other American republics: Dominican Republic, Guatemala, Haiti, Honduras, Mexico, Venezuela, and Nicaragua. Only 20 acceptances are necessary to bring the constitution into force for a permanent Food and Agriculture Organization (FAO).

Following the United Nations Food Conference held in Hot Springs, Virginia, in May 1943, the Interim Commission, working with delegates of all 44 nations, was authorized to draft the constitution and outline the plan of a permanent Food and Agriculture Organization. The need for the early establishment of FAO is emphasized by the serious problems in nutrition, food, and agriculture in many parts of the world.

RIO GRANDE BASIN

(Continued from back cover)

the San Luis Valley in Colorado throughout its southerly extension across New Mexico and continuing southeasterly across Chihuahua and Coahuila is a semi-desert area receiving an average of less than 10 inches of precipitation annually. The Mexican portion of it is called the Chihuahua Desert. Eastward from this area average rainfall gradually increases to approximately 30 inches in the vicinity of the Gulf coast. Much of the rainfall that is received comes in the form of torrential summer downpours and is lost through immediate run-off, frequently causing substantial flood damage. Moreover, the high rate of evaporation reduces the effective value of the scanty precipitation for vegetative growth.

In the northern portion, with its higher altitudes ranging to 8,000 feet in the valley floor at Alamosa, summer temperatures seldom reach 100° F., while farther south and in the dry plains and basins temperatures of 100° to 110° F. are not uncommon. The length of the frost-free growing season is likewise closely associated with altitude and latitude, varying from 100 days or less at Alamosa in Colorado to 240 days or more in the lower reaches of the river.

The predominant soils of the region are the light-gray desert soils, varying to dark-brown and chernozem soils in those areas characterized by higher precipitation and grass cover. In the valley floors alluvial soils, built up by siltation from the river, generally range from sandy soils through sandy loam, silty clay loam, to heavy clay and adobe. These soils of the valleys are generally highly productive under irrigation and, together with water supply, represent the most valuable agricultural resource of the region.

Natural vegetation over the entire region reflects the scanty rainfall of the semi-desert. Over much of the area

the predominant types are thorn shrub and desert shrub, with scanty grass cover. These types give way to grasslands and to montane low forests, with copious grass cover where altitude and precipitation are more favorable for their growth.

Dry-Land Farming

The limitations imposed by climate restrict land utilization to three major types: Dry-land farming, extensive livestock grazing, and irrigation farming. Dry-land farming involves rotational cropping and fallow, and special tillage practices to conserve soil moisture. Distinct areas where dry-land farming is relatively important are scattered throughout the region. The Estancia Valley in central New Mexico, for example, is well known for its production of pinto beans under dry-land farming. Other areas producing cereals, corn, grain sorghums, and hay are found scattered throughout eastern New Mexico, in the Lower Rio Grande plains, and in parts of Chihuahua, Coahuila, and Nueva León. At best, however, crop production without irrigation in this region is a highly hazardous venture beset with frequent crop failure due to drought and soil blowing.

Livestock Ranching

Predominant Land Use

Outside of the narrow irrigated valleys where fertile alluvial soils and available water supply permit intensive farming under irrigation, the predominant land use is extensive grazing of livestock. Sheep are generally found on the tight-soil areas, more resistant to trampling, and where browse is found in combination with species of short grass. Cattle are more uniformly distributed on all land types within the region but tend to be concentrated in the rough mountainous and sandy areas and in localities where grass predominates with little or no browse plants. The general practice in this area is year-long grazing. Most of the cattle are sold as calves or yearlings rather than as 2-year-old or older steers. A substantial part of the Mexican outturn of cattle from the basin are annually marketed in the United States, chiefly as young stock requiring greater growth and finishing on ranches farther to the north. In recent years export sales have been restricted by Mexico to 500,000 head annually, while exports of cows and heifers more than 1 year old are prohibited.

The most concentrated area for the raising of sheep and Angora goats in the United States is the Edwards Plateau in south-central Texas. These species are grazed interspersed with cattle, the latter utilizing the short grass which characterizes the region, whereas the sheep and goats browse on the typical scrubby trees and brush.

Irrigation Farming

The production of a wide variety of crops under irrigation represents the most intensive and, perhaps, the most economically important agricultural enterprise in the region. With the wide range of climatic conditions imposed as a result of a variation in latitude of 12 degrees and elevations ranging from approximately 8,000 feet in the San Luis Valley of Colorado to sea level in the Matamoros-Brownsville area on the Gulf coast, there is a corresponding diversity in the types of crops produced. In the San Luis Valley, where the frost-free season averages only 100 days and has been as short as 68 days, emphasis is placed upon such short-season annual crops as potatoes, grains, and vegetables, and perennial hay crops resistant to winter temperatures. The area is noted for its potatoes, vegetables, and alfalfa. Many range cattle and sheep are wintered in the valley, and dairy cattle and swine are also important.

In the middle Rio Grande irrigation area extending north and south from Albuquerque a similar diversity of crops is found, with the feed crops corn and alfalfa predominating. Many of the farms are of the self-sufficing type. Still farther downstream, in an area extending from the Elephant Butte Reservoir to a point 70 miles beyond El Paso and Juarez, on both sides of the river, cotton production is the dominant farm enterprise, although alfalfa, corn, grain sorghums, vegetables, and apples are also important crops. Dairy and poultry products are becoming increasingly important for the local markets of nearby El Paso, Juarez, and other towns and cities.

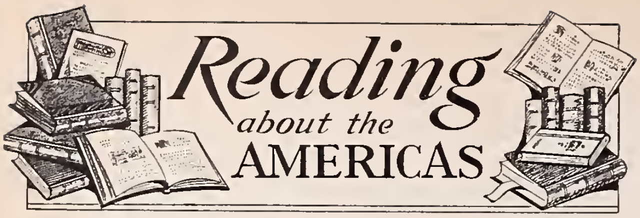
In the Roswell-Carlsbad segment of the Pecos Valley and in scattered small areas of the Rio Grande Valley, the cropping system is also built around the production of cotton. Adjacent to the mouth of the river is found one of the richest agricultural areas in the entire region. This area, known as the Lower Rio Grande Valley, embraces the major part of three Texas counties and an equivalent area of Tamaulipas in Mexico. Natural rainfall exceeding 30 inches annually permits crop production without irrigation, and this practice prevails in the northern portion of the area where cotton and vegetables are produced under dry-land methods of farming. In the more southern portion, where irrigation farming prevails, citrus fruits, winter vegetables, and cotton are produced under highly intensive cropping practices.

Elsewhere in the Mexican portion of the watershed, irrigation development has roughly paralleled that of the United States portion. At the present time, Mexico irrigates approximately 575,000 acres of land within the basin, chiefly on the largest tributaries, the Conchos, Salado, and San Juan. The principal crops are corn, cotton, beans, wheat, and alfalfa hay. The present irrigated area in the United States portion of the watershed, including the Pecos River, is approximately 2 million acres. About 500,000 acres of this amount lie in the Lower Rio Grande Valley in the vicinity of Brownsville.

Conclusions

The most significant promise for further economic development in the Rio Grande Basin is seen in the potentiality for increased irrigation agriculture. Irrigation development in the upper basin has reached the maximum possible under existing water supplies. Further development in this portion of the basin is contingent upon possibilities of major works to divert water from west of the Continental Divide.

In the lower basin, however, a vast acreage, about equally distributed in both countries, appears to be potentially irrigable land, the development of which would be feasible with full utilization of the waters of the lower basin, much of which now flows unutilized into the Gulf of Mexico. Under the pending water treaty between Mexico and the United States, joint development of major works in the main stream would ultimately permit substantial enlargement in the irrigated areas of both countries and would bring a greater measure of security to areas already irrigated, through assurance of dependable water supplies and flood control.



Cocks and Bulls in Caracas, by Olga Briceño. 161 pp., illus. Houghton Mifflin Co., Boston, 1945. This is the personal story of a Venezuelan family's life "just the way it has been," in the heart of Caracas, behind the setting which the tourists see. In these few pages are distilled the skillful interpretations of one who from childhood has been part of the Venezuelan scene, yet has lived abroad enough to explain the customs and social values of her native land in a way to make them real to foreigners. This she does by affording the reader intimate glimpses of the family circle, social customs, foods, amusements, philosophies, and religious life.

The following series of 7 books has been prepared under the auspices of the Committee on Organization for the Third Inter-American Conference on Agriculture, which is to convene on July 24, 1945, at Caracas, Venezuela:

1. *El "Trypanosoma Vivax" Americaño* (Bovine trypanosomiasis and its causative agent *T. vivax*), by Vladimir Kubes, D. M. V. 124 pp., illus. Editorial Grafolit, Caracas, Venezuela, 1944. It contains a summary in English.

2. *La conservación de los suelos y la vida nacional* (The conservation of soils and the national life), by Richard H. Klugh, M.D., and José Antonio Rugeles, Técnico Agrícola. 22 pp., illus. Lit. y Tip. Vargas, Caracas, Venezuela, 1944.

3. *Uso económico del agua de riego* (Economical use of irrigation water), by W. L. Powers, Ph.D. 87 pp., illus. Tipografía Garrido, Caracas, Venezuela, 1944.

4. *El efecto "in vitro" de la tiourea y otros compuestos químicos sobre el virus encefalomielítico tipo Venezuela* (The "in vitro" effect of thiourea and other chemical compounds on the Venezuelan type of encephalomyelitis virus), by Dr. Francisco Gallia. 49 pp., tables. Lit. y Tip. Vargas, Caracas, Venezuela, 1945. It contains a summary in English.

5. *La vacuna al cristal violeta para la prevención del cólera porcino en Venezuela* (Crystal-violet vaccine for the prevention of hog cholera in Venezuela), by Dr. Richard Novicky. Lit. y Tip. Vargas, Caracas, venezuela, 1945. It contains a summary in English.

6. *Los suelos rojos lavados del Norte de Venezuela* (Washed red soils of the Northern Part of Venezuela), by W. L. Powers, Luis Ma. de Eleizalde, and G. Padilla G. 34 pp., illus. Tipografía Moderna, Caracas, Venezuela, 1945.

7. *Abonos naturales de Venezuela* (Natural fertilizers of Venezuela), by Dr. Oscar Grünwald. 16 pp., tables. Impresores Unidos, Caracas, Venezuela, 1945.

Editor's Note.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

SOUTH BRAZIL'S COTTON BOOM

(Continued from page 131)

loans were first offered, and has been increased a number of times to the present basis equal to \$.1406 after deductions for interest and other charges.

Government officials first took steps to prevent over-expansion in cotton growing by restricting the amount of seed distributed in 1943. In 1944, growers did not plant all the seed allotted them, partly because of adverse weather conditions during planting time. Direct control of acreage would be difficult because cotton is frequently interplanted with coffee, corn, peanuts, and manioc and among logs and stumps. Total cotton acreage can be, therefore, only estimated.

Brazil in the World Cotton Picture

In 1943-44 Brazil was the third largest cotton producer in the world. The extent of possible future expansion, particularly in the southern district, if the remaining forests should be cleared and the land planted to cotton, is difficult to estimate. The speed with which the clearing progresses will depend upon the price São Paulo cotton brings in the world market. If it remains at or near present levels, felling of the trees and planting of cotton will move forward rapidly.

AGRICULTURE IN THE AMERICAS — O. R. CARRINGTON, EDITOR

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Gifts of the Americas

THE LIMA BEAN

by CONSTANCE H. FARNWORTH

The lima bean, *Phaseolus lunatus* L., the "aristocrat of the bean family," is considered by some people to be among the most delicious of all our garden vegetables.

South America is its native home, but authorities differ as to whether Peru or Brazil is the correct country of origin. Predominance of opinion places it in Peru, where seeds have been found in tombs with the mummified bodies of Incas. The name probably came from that of Peru's capital, Lima. One variety, however, has been found growing wild in Brazil. Cultivation of the lima bean must have been carried on by man for hundreds of years in order for it to spread as it has done, as the seeds do not scatter of themselves. Europeans have known of the plant for about 300 years. Although early cultivated by the Indians in the southern United States, it was not widely known in this country until after Captain John Harris of the U. S. Navy brought some seed from Lima, Peru, to his farm in Chester, New York. Production in this country advanced rapidly with the opening up of the State of California.

Today this bean is more extensively cultivated in the United States than in any other country, but many South and Central American varieties are still not known here.

Lima beans delight in warm weather. At the same time they require a high relative humidity. Some bean growers say that limas will "make a crop out of fog," which seems to prove true along the coast of California, where night and early-morning fogs occur and bean production is heaviest.

The plant grows as a perennial in its native habitat and as an annual in this country. It belongs to the large family Leguminosae, which also includes common beans, peas, and vetches. The original form is the pole lima, and the bush form came as "sports," or mutations, from them. These "sports" were found growing in the fields of vine beans and, what is most amazing, four entirely unlike varieties were all produced about the same time, three of which are still important commercially.

All lima bean plants are herbaceous and have branches near the ground coming from a central stem. The pole form has long twining branches often 8 feet long which, in most regions, require poles for support but in dry or irrigated areas are left trailing on the ground. The bush bean is short and compact with branches rarely exceeding 2 feet.

The three tribes of pole limas are the sieva, large flat, and potato. The sieva has other names, such as the Carolina, sewee, and civet. Early cultivation of this bean by the Indians of Carolina probably gave it the name Carolina, and the name civet most likely came from its use in civet stew in Europe. In early writings it is called the West Indian bean. The sieva is early-maturing and has thin, short, broad leaflets with small papery pods that split open and twist when ripe, discharging small flat seeds which are white, brown, red, black, or variously mottled. The plants of the large flat and of the potato types are tall, late in ripening, susceptible to cold, and have large but few thick fleshy leaves. The flat limas have broad pods with large, flat, veiny seeds that may be white, black, black and white, black and brown, red, or red and yellow. The potato limas have shorter thicker pods with thicker or plumper seeds.

Many of the present popular varieties of limas have come into use since 1899, when the industry started in the United States. Production of dry limas in California, the largest producer in the United States, has risen from 76,250 tons in 1935 to about 110,150 in 1944. The production of green limas for the United States in 1944 was 26,000 tons of shelled beans for processing and 18,096 tons of unshelled for market.

This legume aids in soil renovation because of its nitrogen-gathering propensities, but its chief use is as a food. In addition to protein, fats, carbohydrates, and minerals, limas are rich in Vitamin B complex and, when green, contain also Vitamins A and C. Limas, often called butter beans in the South, are excellent when used green as shelled beans, or after preserving by drying, canning, or freezing. They are on the market the year around and are an inexpensive nutritious food which can form a delightful substitute for meat in our daily diet since they are rich in starch and in the proteid, legumin.

RIO GRANDE RIVER BASIN—MEXICO

By **John J. Haggerty**

The Rio Grande, or, as it is called in Mexico, the Río Bravo, extends from the mountains of southern Colorado 1,800 miles to the Gulf of Mexico. Its basin includes parts of the States of Colorado, New Mexico, and Texas in the United States, and Chihuahua, Durango, Coahuila, Nueva León, and Tamaulipas in Mexico. For the last 1,200 miles of its length the river forms the boundary between the United States and Mexico. The total area of the basin is about 335,500 square miles, almost as large as the States of Texas and New Mexico combined. Only about one-half of this area, however, is considered contributing watershed. In the remainder are areas known as closed basins where the high rate of evaporation absorbs the precipitation, which is for the most part meager.

The Rio Grande may be divided into two basins, the upper and the lower. The upper basin extends from the headwaters in Colorado to a canyon section at Fort Quitman, Texas, just below the international boundary. The chief tributaries of the lower basin are the Ríos Conchos, Salado, and San Juan in Mexico, and the Pecos and the Devil's River in the United States.

The upper basin, fed by melting snows in the Colorado mountains, provides a fairly uniform and dependable flow during the irrigating season. In the lower basin, on the other hand, the principal water supply is derived from intense tropical storms which tend to occur principally during the summer months. Floods are of frequent occurrence and at times have caused extensive damage to downstream installations. Alternating with floods have been periods of acute water shortage, during which inadequate supplies of water for irrigation have brought hardship to farming communities in both countries.

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Population

When the Spanish explorers first entered this region, early in the sixteenth century, they found the Indians growing corn, beans, cotton, and other crops and diverting water from the streams to their crop land under primitive but highly effective systems of irrigation. Spanish colonization began in earnest about the year 1600 and continued with little interruption until approximately the middle of the nineteenth century, when the northern part of the region became a part of the United States. Since that time, agricultural development in the United States and Mexican segments of the watershed has continued along separate but similar courses. The population throughout the region, including the United States portion, remains basically Spanish-American in traditions, customs, and language.

Although the population of the watershed cannot be precisely determined, somewhat less than 2,000,000 people, about equally divided between the two countries, are believed to be distributed within the Rio Grande watershed.

Climate, Soils, Vegetation

In this region, once generally characterized as the Great American Desert, rainfall is the most important climatic factor limiting agricultural development. Straddling the river from

(Continued on page 136)

Agriculture in the Americas

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August 1945

NAMES & NEWS

To Study at Ames

Américo Groszmann, Professor of Genetics at the *Escola Superior de Agricultura*, Viçosa, Brazil, has come to this country to take special courses at Iowa State College.

●

Attends Inauguration Ceremony

Ross E. Moore, Chief, Technical Collaboration Branch, Office of Foreign Agricultural Relations, recently returned to Washington after representing the U. S. Department of Agriculture at the official inauguration of the Cooperative Agricultural Experiment Station at Tingo María. Dr. Moore has supervised the work of this Station since it was established in 1942.

●

Makes Cinchona Studies

Ernst J. Schreiner, Senior Silviculturist, U. S. Forest Service, has been detailed to the Office of Foreign Agricultural Relations and is working in Guatemala, where he is evaluating cinchona planting materials as breeding stocks and assisting in devising a cinchona-breeding program for these materials. Dr. Schreiner expects to return to the United States about September 1.

●

Arthur E. Bechtel Visits Experiment Stations

Arthur E. Bechtel, Assistant Horticulturist, Bureau of Plant Industry, U. S. Department of Agriculture, recently completed a 6-week tour of Mexico, Guatemala, Honduras, Costa Rica, Canal Zone, Trinidad, and the Dominican Republic, where he inspected scientific work being carried on in the various Experiment Stations. At the conclusion of his trip, Mr. Bechtel returned to Marfranc, Haiti, where he is working with the budding, planting, and development of Hevea rubber trees at the Experiment Station.

Studies Cacao Problems

Robert L. Fowler, Horticulturist, Office of Foreign Agricultural Relations, recently completed a 2-month trip to Colombia, Costa Rica, Nicaragua, Trinidad, Panama, and the Canal Zone, where he studied problems of propagating and growing cacao applicable to his work in Ecuador.

●

Visitor From Brazil

Sr. Francisco de Assis Iglesias, Director of the Division of Vocational Agriculture, Department of Agriculture, São Paulo, Brazil, is spending some time in the United States. While here he will visit a number of agricultural colleges and experiment stations and will lecture on various phases of vocational agriculture, forestry, and the silk industry in Brazil.

●

Returns to Guatemala

Charles S. Simmons, Soil Scientist, Office of Foreign Agricultural Relations, following a period of research and conferences with U. S. Department of Agriculture officials, has returned to Guatemala, where he is assigned to the Cooperative Agricultural Experiment Station. Mr. Simmons' work at the Station includes soil surveys, research on the growth of economic plants under divergent conditions in Central America, and the rendering of technical advice to cooperating agencies of foreign governments and private producers of economic plants.

●

Starts on Tour

Robert L. Pendleton, Soil Scientist, Office of Foreign Agricultural Relations, continued on from Peru recently for an extended period in Ecuador, Panama, Costa Rica, Honduras, El Salvador, Nicaragua, and Guatemala. Dr. Pendleton is making a reconnaissance of soil types and land use, with special emphasis on conditions suitable for the planting and cultivation of complementary crops, including a survey of cinchona plantations. He will also visit the Inter-American Insitute of Agricultural Sciences, the Bureau of Plant Industry Rubber Station, the Goodyear Rubber Plantations, and the *Escuela Agrícola Panamericana.*

Agriculture IN THE *Americas*

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Down the Magdalena

The Magdalena River is a main artery for transportation of agricultural products between central Colombia and the Caribbean and Atlantic Ocean. Dr. and Mrs. Dunn, who made the trip down that river on a stern-wheeler, here recount some of their experiences.

by W. E. DUNN and
LINDA T. DUNN

The use of the airplane is now so general in Colombia that reliable information on travel by rail and river steamer, formerly the chief means of communication, is often difficult to obtain. Especially is this true of such a trip as the one which we took, from Bogotá to the Atlantic Ocean port of Barranquilla via rail and the Magdalena River, a trip seldom taken by North Americans or other foreigners.

First Lap by Rail

A daily train runs from Bogotá to Puerto Salgar, a distance of about 125 miles. The trip is a tedious one, requiring 8 or 9 hours, but along the way are many interesting and colorful things to see. Passengers usually carry their own lunches and drinking water, though a restaurant car is attached to the morning train. Bogotá is 8,700 feet above sea level; Puerto Salgar is about 640. Starting out with overcoats and sweaters, one must shed to the lightest attire by the time Puerto Salgar is reached in the late afternoon.

Leaving Bogotá in the morning, the train runs westward across the *Sabana* of Bogotá, through broad level pastures of natural grasses and fields of corn and wheat. The air is clear and bracing at that altitude, and the landscape reminds one of some parts of the Middle West in the United States. Shortly beyond the town of Facatativá, the railroad leaves the *sabana* and starts its long descent of the slopes of the Eastern Cordillera. The air gradually becomes warmer, and pastures and wheatfields give way to steep mountain slopes covered with forests, coffee *fincas,* and then to patches of sugarcane, corn, and yuca.

The line passes through a number of fair-sized towns, including such popular vacation resorts as Sasaima, where the elevation is approximately 4,000 feet, Villeta, and Utica, gradually descending from the mountain coolness

Courtesy of Pan American Union

Typical stern-wheel, wood-burning river boat on the Magdalena.

of Bogotá to the low, hot Magdalena Valley. From Villeta the train follows the deep winding gorge of the Río Negro.

Occasionally there are groves of feathery bamboo, which seems to grow all over Colombia. The people use it in numerous ways—for building houses, fences, bridges, ladders, pipe lines for irrigation, and as palings sunk into the river to hold back the water and afford quiet fishing places.

Change to the Stern-wheeler

Puerto Salgar is reached late in the afternoon, and there connection is made with one of the stern-wheel steamers plying up and down the Magdalena River. Passengers must walk a quarter of a mile from the railway station to the steamer pier, followed by porters carrying trunks and hand baggage.

As soon as all passengers are on board, the boat pulls away from shore and proceeds almost directly across the river to La Dorada, where it remains all night. Navigation on the upper reaches of the Magdalena, except during the flood season from October to December, is feasible only during the day time, and the river boats usually tie up and load cargo at the various ports during the night. The trip to Barranquilla requires from 3 to 4 days if no mishaps are encountered, a distance of about 560 miles.

Two companies operate passenger service on the river. The larger and older has a fleet of 22 old-type stern-wheel steamers and 56 barges, with a monthly capacity of nearly 28,000 short tons and 3,000 passengers.

Role of the Magdalena in Colombian Economy

After actually making the trip down the Magdalena one can better visualize the importance of this great artery in the economy of Colombia. The river affords outlet to the Atlantic Ocean for 10 of the 14 departments of the Republic. Its total length is more than 950 miles, of which about 590 miles are below the rapids at Honda, known as *Salto de Honda,* separating the lower river from the upper. Cargo coming up the river must be transferred at this point from the larger to the smaller river boats or shipped over the railway or highway between La Dorada and Honda. According to leading Colombian authorities, some 60 percent of Colombia's total import and export commerce is transported by way of the Magdalena. In 1943 its river craft carried more than 1,163,000 short tons of merchandise and 175,339 passengers.

Upstream traffic consists of imports en route from Barranquilla and Cartagena to Bogotá and to the upper valley. Boatloads of cattle from Bolívar also go up to be fattened in pastures along the river and on the Tolima Plains. These plains start a short distance south of Honda and extend, with some interruptions, for about 60 miles to the south. From the west side of the river, these broken plains slope gradually upward to the west for some 40 miles to Ibagué at the base of the Cordillera Central.

Most important downstream cargoes consist of coffee, which is grown on the slopes of the mountains both to the east and west of the Valley. Other products are grown there too, but most of them are consumed in the Valley or are shipped to Bogotá or to other towns on the *sabana.* Corn is grown all along this part of the river, particularly near Girardot. Cotton is produced near Girardot and around Armero. Tobacco is raised west of Girardot and at Ambalema, just south of Armero. Rice is produced in suitable areas scattered from Armero to the south even beyond Neiva.

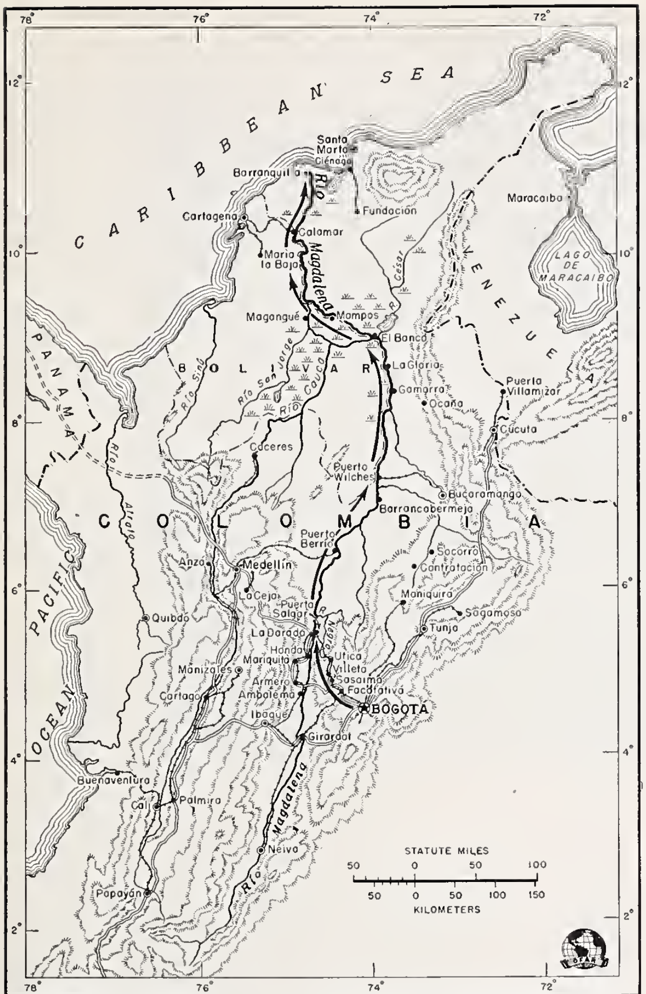
Travel on a Magdalena River Boat

At La Dorada the boat remains tied up for the night, starting down the river at daybreak. The passage downstream is fairly swift for a stern-wheeler, as the current runs from 5 to 6 miles an hour.

Each of the river steamers usually pushes one or two barges before it. These barges draw 2 or 3 feet of water, while the steamer itself draws from 4 to 5 feet. If the barge touches bottom, the boat is immediately stopped before it gets on the sand bank, backs up, and seeks another channel. Almost endless maneuvering is required to get around the sharp bends and shallow places.

The larger river boats have three decks—the first for freight, the second for first class, and the top for *de luxe* cabins. The cabins are fairly comfortable, having private bath and, in some cases, partial air-conditioning. Food is substantial, but passengers do well to supplement the diet with canned meats and fruits. Most of the boats

Dr. Dunn has held many important foreign service posts in Latin America, the most recent being Counselor of Embassy for Economic Affairs, Bogotá, Colombia. Mrs. Dunn accompanied Dr. Dunn on the trip down the Magdalena. **Acknowledgment is made by the authors for assistance in the agricultural phases of this article by John A. Hopkins and Lawrence W. Witt.**



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Route followed by the Dunns on their trip down the Magdalena.

carry an orchestra, the music of which mingles with the noise of the loading at night, cries of the stevedores, stentorian whistles, and ringing of bells. Passengers are advised to secure cabins on the left-hand side of the boat to be away from the noise and stuffiness during the night loadings. Most of the ports are on the west side of the river, and the boats are turned around so that they face upstream when loading. A useful travel aid is an insect spray gun, for mosquitoes may be most annoying, especially when the boat is tied up in the ports. The lightest-weight clothing possible is appropriate on the river.

Life on a stern-wheeler going down the Magdalena is full of interest during the entire 3 or 4 days and nights. Sometimes the ice supply runs out between ports of call, and mosquitoes are ever-present. But the scenery is superb for long stretches, with low-lying banks, wide valleys, jungles in parts so dense that no roads or clearings have been made, and off in the distance the mighty mountains rising with lazy clouds floating around their heads. Sometimes we amused ourselves by watching for alligators and other animals or birds that might be sunning themselves on the river banks. There were beautiful egrets and herons, and once two little spider monkeys sitting on a tree-top. In the afternoons, the chief steward passed curuba ice cream during the tea hour. The fruit of the curuba tree is made into ice cream which resembles peach in color but which has an exotic flavor all its own. The towns, which the loading of the boat gave time to explore, furnished fresh oranges, limes, bananas, and pineapples, and sometimes good cheese. As always, after such a trip the handicaps are forgotten and one remembers only the pleasures.

Along the River

The area immediately north of La Dorada is not as fully developed as that to the south. Much of the best land, particularly flood plains along the river, is cleared and devoted to pasture for cattle, but a large part remains in forests. Besides those which are raised in the area, many cattle from Bolívar are purchased and fattened on the plains for from 9 to 12 months. They are then sold in Bucaramanga, in Medellín, or to employees of the oil companies operating in the region between La Dorada and Puerto Wilches. Corn is grown and sent largely to Medellín by rail from Puerto Berrío, although small amounts move along the river. In addition to corn, only subsistence crops such as yuca and plátanos (plantains, or bananas) are produced.

The first stop on the trip down the river is usually Puerto Berrío, which is the connecting point for the railroad to Medellín, the second city of the Republic. The next important port of call is Barrancabermeja, the site of a large oil refinery, with a population of some 15,000. The influence of the oil industry is reflected in the greater relative prosperity of this town, with its paved streets, up-to-date buildings, and various modern conveniences.

Shortly beyond Puerto Wilches, which is the terminal of a railroad leading to Bucaramanga, the capital of Santander, the river widens out, flowing through several channels until after its junction with the Cauca River. Many areas alternate between swamps and secondary river

Small dugouts, carrying farm produce, often meet the larger ships in mid-stream

channels. Farmers' houses are generally built on stilts in order to be above water levels during floods, and cultivation is confined largely to higher lands. The lower land is rather fertile, but because of the frequent flooding it can be only partially utilized. Again, corn and subsistence crops are the principal crops. Cattle are fattened near the river in the dry season and moved to higher grounds when the river rises.

There are many small towns along the way at which the main passenger boats do not stop but which are served by smaller boats specializing in freight. These little boats, several hundred of them, will stop and load freight almost anywhere it is found, either from the shore or from the small dugout canoes which have assembled mixed loads of corn, beans, chickens, and perhaps a human passenger or two. Frequently, the big boats draw up to the bank to load cattle going down to Barranquilla, or to pick up wood to fuel the power unit.

Gamarra is a typical small river port, its chief importance being that it is the terminal of an aerial cableway leading eastward to the town of Ocaña, almost 30 miles away. Near La Gloria is Puerto Sagoc, one of the stations of a petroleum pipe line. El Banco is a commercial and fishing center.

Magangué, second only to Barranquilla as a river port, is an important outlet for the cattle country of the Sinú, Sincelejo, and adjoining districts. From here highways lead to a number of rich agricultural sections. Through this port are shipped thousands of cattle each year that have been raised in the central part of Bolívar Department or even in the Sinú Valley to the west. These cattle are sent from the producing ranches at about 4 years of age in semi-fat condition, traveling on foot for 10 to 15 days to Magangué and thence 4 to 6 days up river by boat to the fattening pastures. Besides cattle, Magangué also ships to Medellín lard rendered from pigs raised in the Sinú Valley and other parts of Bolívar. In the opposite direction, Magangué ships to Barranquilla considerable rice, and some corn which has been produced in the hinterland west of the town.

The final port of importance before reaching Barranquilla is Calamar, which is the terminal of the railway leading to Cartagena, a fine ocean port. The length of this line is about 65 miles, and trains are operated daily in both directions, with tri-weekly *autoferro* (a Diesel-powered car) service. A short distance below Calamar, the Magdalena River is joined by the *Canal del Dique,* a partly natural and partly artificial waterway constructed by the Spaniards in colonial times. Through this canal a few river boats operate directly from Cartagena up the Magdalena without transshipment of cargo. Cartagena is connected also with Barranquilla by a modern highway.

Arrival at Barranquilla

Six hours after leaving Calamar, the boat reaches Barranquilla, the third-largest city of Colombia. The city is situated about 12 miles up the river from the Atlantic Ocean, but as a result of the civic *Bocas de Cenizas* project, terminated in 1936, jetties, modern piers, and other port facilities were constructed so that ocean-going vessels could ascend the Magdalena to the city of Barranquilla itself. The necessity of keeping the channel clear of sediment brought down by the river has proved at times a hindrance to Barranquilla as a deep-water port. This problem, however, is receiving serious study by engineers and seems likely to be solved satisfactorily in the near future.

Courtesy of Pan American Union

Mouth of the Magdalena River.

Citrus in Latin America

Oranges, grapefruit, lemons, limes, kumquats, pomelos—and all the other cool, juicy fruits known as citrus—grow in the Americas, both wild and cultivated. The industry has its problems, but they must be overcome, for the world needs citrus fruits.

by HUBERT MANESS

Citrus fruits are widely grown in Central and South America. In many areas they have become wild and are frequently found growing in thickets, in the forest, or along the streams. Christopher Columbus is said to have brought the first orange and other citrus seeds from the Canary Islands on his second voyage, in 1493, and planted then on Hispaniola. Early Spanish and Portuguese explorers soon made other introductions, and these were continued by missionaries, until citrus became established in all adaptable areas of Central and South America.

The story is a familiar one of how the Paraguayan, General López, during the Paraguayan War, commanded that oranges be planted on all estates and encouraged people, whenever they ate an orange anywhere in Paraguay, to plant the seeds there. The orange trees which still grow wild throughout the forests of Paraguay are a source of refreshment to weary travelers, who delight in stopping along jungle trails and refreshing themselves with great numbers of sweet, juicy wild oranges.

Travelers on the broad yellow waters of the Amazon River have an equally delightful experience when the boat pulls up along the jungle-covered banks and they go ashore to gather sweet oranges from trees growing wild. In the Amazon forest oranges do not color well

The author was Vice Consul in Manaos, Brazil, from 1940 to 1943. During the last 2 years he has served as Vice Consul in the Agricultural Attaché's Office, American Embassy, Rio de Janeiro, Brazil.

but remain green like the jungle which hides them. When ripe, however, though still green in color they are often sweet and juicy.

Many Varieties

Many varieties of the various fruits are grown in the different countries. There are sweet and bitter oranges, little green limes, decorative kumquats, rough lemons, and pomelos as big as a man's head. The pomelo is native to Southeastern Asia, where it is popular as a fresh table fruit. The modern grapefruit, which originated in the West Indies in the eighteenth century, is believed to be a bud mutation or a cross of the pomelo. Citron, which is somewhat like the lemon in appearance, is used a great deal for making clear candied fruit, popular especially around Christmas time. Citron is the oldest citrus fruit known to European civilization. It was recorded in literature as far back as 300 B. C. and for centuries was the only citrus known to Europeans, until the sour orange and the lemon were introduced. The sweet orange did not reach Europe until about 1400 A. D., although it had been grown in China for many centuries. The sweet orange in its many varieties is by far the most widely grown citrus fruit in South and Central America. Many seedlings and bud mutations have been developed in the 400 years that citrus has been grown there.

Harvesting fruit from an 18-year-old grapefruit tree.

Place of Citrus

The growing of citrus fruits in most Central and South American countries is not carried on by large commercial farms as in the United States but by small growers who produce oranges and other citrus fruits for home consumption or for supplying local markets. No home is considered complete without citrus trees growing in its patio or around its walls. Only in Brazil, which is the largest producer of oranges, has large-scale commercial production developed, and, to a lesser extent, in Cuba, Mexico, and Argentina.

Citrus fruits play an important part in family life. The softness of skin of the beautiful señoritas is often attributed to their skillful use of cream and lotions made from citrus oils and leaves; and what a pleasing medicine is hot tea made from the leaves or the fruit of the bitter orange! The mastery of cooking fish, game, and meat is partly accomplished by the skillful use of flavoring with tidbits of citrus fruit and peel.

Paraguay and Brazil produce rather large quantities of orange oil for export. This oil is obtained from the peel of the orange by a simple distillation process and is widely used in the United States for making orange extract. Cuba raises grapefruit and limes for off-season export to the United States, and Mexico raises limes for export to this country. Ecuador, from time to time, ships fresh oranges to Peru and Chile.

Oranges are highly esteemed in South and Central America, but lemons and grapefruit are not as popular as in North America. Sour limes take the place of lemons, and in many areas the words are synonymous. The lime is more suitable for growing with little care in the hot humid climate prevailing in many citrus areas. Lemons require careful spraying because of the prevalence of citrus scab and other diseases and require a long curing period, which further complicates the production of the fruit. Curing is the process of picking the lemons while a portion of the rind is still green and storing them in a cool place for some weeks. During this period the flavor and the quality actually improve.

The grapefruit, except in large cities, is not as popular as the sweet lime. Most North Americans find the mild, sweet lime tasteless, but to the people of South and Central America it is full of flavor and is a delightful fruit, especially for those having "tender stomachs."

Juices of citrus fruit are popular, but in many countries the whole oranges are still most appreciated as fresh table fruit. Brazilians have a delightful custom of peeling oranges in such a way that a base of the peel is left on the fruit so that it sits upright and can be eaten with a knife and fork. Oranges are generally served in this manner for breakfast and at lunch time, forming a characteristic part of Brazilian meals.

Typical home orange grove, State of Minas Gerais, Brazil.

As early as 1820 the Brazilian port of Bahia (São Salvador) became known far and wide for its delicious, large, sweet, juicy oranges. Travelers and sailors looked forward to a treat when their ships called at the port of Bahia, and throughout their travels thereafter helped spread the fame of Brazilian oranges. In 1870 grafted seedlings of this Bahia orange were sent to the U. S. Department of Agriculture. It has now become a leading early orange of our California industry, known to us as the Washington Navel.

Oranges are produced in all Brazilian States, but commercial production for export is mainly confined to the State of São Paulo and an area near the city of Rio de Janeiro. Production of oranges in Brazil has shown a remarkable development during the last two decades. In 1921 Brazil produced 2 million boxes, and by 1939 the number had risen to over 35 million. This makes Brazil one of the largest producers of oranges in the world.

The Bahia Navel is the leading early orange grown in São Paulo. It is especially popular in the European market. England was Brazil's best customer before the war, normally receiving well over 60 percent of that country's exports of the fruit. The Bahia Navel is preferred in São Paulo because it ripens early, before the Mediterranean fruitfly causes serious damage. The flies prefer coffee cherries and do not seriously bother oranges as long as there are ungathered coffee cherries to infest.

The second-most-important export orange in Brazil is the Pera, a late orange comparable to the Valencia. It is the leading orange in the Rio de Janeiro area. It has the advantage of remaining fresh and juicy for a long time and is very sweet. The Pera is a great favorite in Argentina, which before the war was Brazil's second-best customer and during the war her best customer. This orange is especially popular in Argentina because it reaches the market at a time when other fresh fruits are scarce. The Pera attains a high state of quality in the Rio de Janeiro district and, many believe, can rival any other orange in the world.

The Navel season in the State of São Paulo extends from April to June. The Pera season in Rio de Janeiro begins in June and extends into September or even later, depending somewhat on weather conditions.

In general, spraying and irrigation are not practiced in Brazil. Cultivation consists mainly in controlling the weeds and grass. These factors tend to keep the cost of producing oranges low.

The greatest stimulus to orange production in Brazil was brought about by the exceedingly low coffee prices of the 30's and the country's ability to produce oranges cheaply for the world market. About 1930 the boom began and it continued until orange trees were planted on literally all available land of the hillsides and valleys around Rio de Janeiro. Much land was planted that was

Tristeza, **or root rot, has killed approximately 80 percent of the orange trees in the State of São Paulo and is making inroads in the Rio de Janeiro district.**

undesirable, that is, too swampy or too hilly, and sometimes the soil was so poor that the trees died after a few years of bearing. In the State of São Paulo the rapidly increasing production of oranges became concentrated around Limeira, Sorocaba, and Taubate. In general, the groves were better laid out and cared for in São Paulo than in Rio de Janeiro.

The prosperous period of Brazilian orange production came to an end with the loss of export markets in 1940 because of the war. Some producers turned to the production of orange oil, but this industry offered only partial relief. Because the groves offered no profits, sometimes not even paying for maintenance, they often became overrun with tall grass, weeds, and vines. A large amount of the fruit, during the early years of the war, was allowed to rot in the groves. The Mediterranean fruitfly increased alarmingly. Some owners abandoned their groves and allowed cattle to graze on them. Many groves were destroyed by grass fires. The Brazilian Government took measures to aid the producers, but, with the prolongation of the war, continued aid became increasingly difficult.

Disease Menace

The greatest destruction of orange groves, however, has not been due to neglect but rather to a new unidentified disease. In Brazil it is called *tristeza,* or root rot. Although little is known about its origin or control, it has killed approximately 80 percent of the trees in the State of São Paulo and is making inroads in the Rio de Janeiro district. The disease attacks citrus grafted on sour-orange rootstock, but apparently sweet orange is resistant. It is more serious in the São Paulo area because most of the commercial groves there are grafted on sour orange. It is less severe in the Rio de Janeiro area because of the smaller percentage of sour-orange rootstock. It was first noticed in the Taubate zone in 1937, and from there has spread to all important citrus-growing areas in Brazil. In 1932 it occurred in the Corrientes section of Argentina. Since then it has spread progressively to other zones until it has destroyed many of the orange and grapefruit groves in Argentina, wherever sour-orange rootstock was used. The disease is present also in Paraguay and in other commercial citrus groves of South America. What is believed by scientists to be the same disease has broken out recently in California under the name "quick decline."

The first outward symptoms of the disease show up in the leaves, when the dark-green color becomes bronzed. The leaves become paler and begin falling until most of the branches are bare. Some trees are able to renew their foliage, but the new leaves do not attain normal growth. After a season or two the trees become skeletons and give the appearance of having been scorched by fire. In many groves all the trees are killed within 1 to 3 years.

Citriculturists of the Brazilian Ministry of Agriculture and other specialists have made detailed studies of the disease and are doing all in their power to control it, but up to the present no economical method of control has been found. Interest is keen in renewing the groves, but caution is being used until a desirable rootstock can be found.

The Argentine Ministry of Agriculture, through its experiment stations, has made progress in overcoming the disease by renewing the groves with sweet-orange and sweet-lime rootstock. The buddings have been made high in order to protect the trunks from gummosis disease. Most commercial groves in the world were budded to sour orange, because the sweet orange, which is highly susceptible to gummosis, seemed less desirable. Now, with the appearance of the new root-rot disease which attacks sour orange, sweet-orange rootstock seems preferable, for gummosis can be controlled.

Outlook for Citrus

The citrus industry in Latin America will not be completely destroyed. The problem there, and perhaps in the whole citrus world, is the old one of obtaining desirable rootstock. Many commercial growers plan to replant their groves as soon as a resistant rootstock can be found. Government specialists in several countries are working hard to help growers overcome this disease, and there is strong hope that a control measure will be found in the near future.

Desmodiums—"Alfalfas of the Tropics"

The group of leguminous plants known as the desmodiums may soon attain the same place in the livestock industry of tropical areas that alfalfa now occupies in northern climates. The Inter-American Institute of Agricultural Sciences is experimenting in their use as forage crops.

by **ROBERT L. SQUIBB**

In the American tropics, the sight of cattle standing "up to their necks" in what appears to be excellent grass, yet nearly starving to death, is not uncommon. The chief reason is that the nutritional content in many of the tropical grasses is low because of a widespread deficiency of proteins and minerals.

The problem that faces the animal industry of the American tropics because of this low content of nutrition is a serious one. The majority of the livestock feed solely on grass. Only a small percentage of animals ever receive supplemental feed, and these are usually dairy cows. When the pasture grasses do not contain sufficient food value to provide more than mere maintenance, a lowered efficiency in production of milk, meat, and power is the result. The growing and fattening periods for animals to arrive at reasonable market weights may extend as long as 6 years. Milk production may be extremely low. Diseases, lack of sanitation, parasites, excessive heat and humidity all play a part in creating these conditions, of course, but the low plane of nutrition content in the pasturage is important.

Experiments at the Institute

To meet this problem the Institute has been experimenting. First, the low nutritive plane had to be verified by experiments in supplementing cattle feed under tropical conditions. Results have shown that cattle supplemented with a salt mixture of equal parts by weight of bonemeal, oystershell meal, and salt may double the daily gains of an unsupplemented or control group. Cattle supplemented with the same salt mixture plus one pound of cottonseed meal per head each day are found to treble the daily gains of the control group.

The mineral deficiencies can be accounted for partly by the heavy tropical rains which leach the soils, carrying off the soluble salts of calcium and, to some extent, of phosphorus. As these two elements compose approximately 75 percent of the mineral matter in the entire bodies of farm animals and more than 90 percent of that in their skeletons, the importance of these two elements to the animal diet is apparent. These deficiencies can be corrected by supplementing the feed of the animals with sources of phosphorus and calcium, such as bonemeal and calcium carbonate of oystershell meal. Some suggest, if practical, the addition to the soil of these two elements which will in turn build up their content in the plants.

Protein deficiencies, on the other hand, present more of a problem. Throughout the American tropics there is an over-all low production and high cost of feedstuffs which are rich in proteins, such as sesame, cottonseed, peanut, fish, and meat meals. To supplement the low protein intake of animals in these regions with these valuable

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Young plants of *Desmodium leiocarpum.*

protein feeds is not, therefore, always practical. Livestock men must look to production of plants high in proteins, either by cultivation or by interplanting in pastures.

Research Important

Growing in abundance throughout the South and Central American tropics are numerous species of *Desmodium* genus. These native leguminous plants are high in protein, are highly palatable, able to sustain the competition of other plants and grasses, and easy to cultivate.

In Guanacaste, Costa Rica, for example, the pastures are lush and green during the wet season. During the dry season, as these available pastures dry out, the cattle

Some kinds of desmodiums are called *Pega Pega* because the seeds cling to the clothing.

are turned into *sitios,* undeveloped lands, often not even fenced. At the end of the dry season the cattle leave these *sitios* in excellent flesh. This is believed to be due to the presence of numerous high-protein plants. A large number of these wild plants are desmodiums.

Livestock men know of these plants and their ability to make animals grow and fatten. They have given them such common expressive names as *Engorda Caballo, Engorda Cabra, Bejuco Engordadora* (the verb *engordar* means to fatten, *caballo* means horse, *cabra* is goat, and *bejuco* is vine). There are yet greater numbers of plants which are not known, and through the lack of knowledge and ability to recognize them these plants are destroyed in the process of clearing new pasture lands.

To meet the need for the growing of legumes and pasture grasses of high nutritive values the Institute has established a Section of Forage Crops in the Division of Animal Industry. Because the problem of livestock feeding in the American tropics is so great and pressing, the economic cultivation of palatable and nutritious forage crops and pasture grasses is being studied in conjunction with livestock feeding experiments at the station.

In the experimental plots to date 15 varieties of grasses and approximately 20 varieties of legumes are growing favorably in pure stands under warm tropical conditions of high rainfall and humidity. There are approximately 550 acres in pastures of Para grass (*Panicum purpurascens*), Guinea grass (*Panicum maximum*), Gamalote (*Axonopus scoparius*), Honduras grass (*Ixophorus unisetus*), Elephante grass (*Pennisetum purpureum*), and molasses grass (*Melinis minutiflora*)*;* 35 acres in pastures of molasses grass mixed with legumes; and 100 acres in the process of being developed.

Exploratory work is constantly in progress. New plants found in pasture and undeveloped areas are being tested as to chemical analysis, palatability, digestibility, economic methods of cultivation, and the ability of the new-found plants to sustain competition. Seeds of wild desmodiums are being collected locally, and some are imported from other countries. These are all planted in trial plots.

The Genus Desmodium

Species of the desmodiums have long been known throughout the tropics and are found growing under practically all tropical conditions. In Florida a common species is the Florida beggarweed, *Desmodium tortuosum.* Mexico has a large number of species. Two are cultivated for livestock: *D. triflorum,* which grows around the Gulf of Mexico and is used as a substitute for alfalfa and clovers; and *D. orbiculare,* which grows in the higher altitudes of Mexico and is noted as a special fattener for goats, hence its common name *Engorda Cabra.* El Salvador is the home of one of the most famous of the desmodiums, *D. nicaraguense,* commonly known as *Engorda Caballo,* This plant is now extensively cultivated by livestock men in that country. The other Central and South American countries have their share of species of the genus. Brazil, for example, cultivates extensively *D. leiocarpum,* known as *Mermelada os Caballos.* Both *D. nicaraguense* and *D. leiocarpum* are among those now under successful cultivation at the Institute.

Indications are that many others of the genus, native to each of the tropical countries, are awaiting discovery for use as livestock forages. Many of them have yet to receive their species names. They are known to the farmers only by such common names as *Pega Pega, Alfalfa Montes,* and *Hierba Cuartillo.* This causes much confusion. For example, a common name like *Pega Pega* serves for many species of *Desmodium* and also many not in the genus. The name is derived from the characteristic that the seed

has of clinging to clothing and animals.

Laboratory analyses show the desmodiums to be highly nutritious. *Desmodium nicaraguense,* as an example, when cut prior to maturity, has 22 percent crude protein, 36 percent nitrogen free extract, 18 percent crude fiber, and 11 percent total ash content. Others run high in the sorely needed proteins, ranging from 6 to 22 percent crude protein. Nearly all of them are highly palatable stock feeds. One has only to observe animals grazing in new pastures or *sitios* to see them selecting these nutritious plants.

Results of field tests at the Institute and other experiment stations throughout the American tropics indicate that the genus *Desmodium* lends itself readily to cultivation. It is well adapted to warm moist climates and acid soils. Most of the species are vigorous growers and strong competitors, able to sustain the competition of other plants and grasses. These characteristics are advantageous, especially when inter-plantings are desired for the purpose of raising the protein content of established pastures.

Cultivation of the Desmodiums

Desmodiums can be cultivated in several ways. Seed can be sown directly in the field or in beds, the young plants being transplanted later. Cuttings propagate so easily that many livestock men use this method alone, obtaining excellent results at low cost.

Results observed at the Institute indicate that to obtain maximum germination all seeds of this genus should be scarified. This can be easily accomplished by "scratching" the seeds in a revolving drum lined with sandpaper.

As most of the desmodium seeds are small, similar to alfalfa, the preparation of the seedbed is most important. The bed should have good drainage, and the soil should be well worked. Seed can be sown shallow, about as thick as carrot seedlings, and in rows 12 inches apart. One of the greatest causes of uneven germination is the tendency of heavy rains to either cover the seeds too deep or wash them out. When the young plants in the beds reach a height of 4 to 10 inches and are hardened to the weather, they may be set out in the fields. Sufficient leaves should be removed to lower the transpiration rate.

Excellent results have been obtained in the transplanting of desmodiums by topping the plants and cutting the roots with a knife. This procedure consists of encircling a 14-inch plant with a large knife thrust vertically into the soil and cutting all roots in a 4-inch diameter around the plant. The soil is then pressed tightly about the plant and it is allowed to remain for 8 to 10 days. During this period the plant begins new root and leaf development and, when transplanted, is ready to take hold in the new surroundings. This procedure was suggested by the United States Rubber Station at Turrialba as a result of their success in transplanting young rubber trees in this way.

Many stockmen prefer to sow the seed directly in the field. This is practical, and the percentage of germination is in proportion to the care used in preparing the seedbed and to the effect of the tropical rains. Results show that the seeds and seedlings of *Desmodium* are strong growers.

Desmodium nicaraguense propagates well from cuttings. The El Salvador Agricultural Experiment Station has found that large aged stems quartered lengthwise and planted horizontally, with a covering of approximately ½ inch of topsoil, yield an excellent crop of shoots. This method is practical for interplanting directly in the field. An article on the desmodiums was written by Félix Choussy for *La Asociación de Ganaderos de El Salvador* and pub-

Transplanting young *Desmodium* plants into beds.

lished in 1943 under the title *"El Engorda Caballo."*

The majority of the desmodiums are so palatable that livestock feed on the plants regardless of their size or thickness. The type of growth can, however, be regulated by planting distances. *Desmodium nicaraguense* planted at wide intervals often attains a height of from 8 to 20 feet, a type of growth preferred by some livestock men for interplanting in established pastures. When it is planted thickly, the growth resembles that of alfalfa. Even though the stems are larger than those of alfalfa, livestock readily eat them. They make excellent green fodder, or may be used for hay or silage. Two to seven cuttings a year may be made in the tropics with many members of this genus, or they may be pastured directly.

Each tropical country has its own undeveloped resource of these high-protein native legumes which, if properly developed, may bring about a higher plane of nutrition in feed for the livestock of the tropics. Thus the desmodiums would earn for themselves the title "Alfalfas of the Tropics."

Propagating Derris by Cuttings

Considerable loss sometimes results from a lack of knowledge of how to handle derris cuttings that have been shipped for propagation. These explanations, coming from the Federal Experiment Station in Puerto Rico, show how it is done there.

by DAVID G. WHITE

During the past 3 years over 2,000,000 cuttings and plants of *Derris elliptica* (Wall.) Benth. have been distributed throughout the tropical Americas from the Federal Experiment Station in Puerto Rico. The purpose of the program is to provide an increased wartime and postwar source of the important insecticide rotenone. The history and methods of this distribution have been discussed previously in this publication.* In many instances, however, cuttings and even, in some cases, rooted plants did not survive the rigors of travel and inexperienced handling. This loss, although regrettable, may be rectified in the future if careful attention is given to certain details. Recent work at this Station would seem to make worth while an added explanation of the factors which enter into the successful propagation of derris.

Selecting the Cutting Material

Although small leafy cuttings can be rooted, stronger plants are obtained sooner from leafless cuttings made from mature stems. In general, root development from a piece of a plant, such as a cutting, is closely associated with the amount of carbohydrates which have accumulated in the region from which the cutting was taken. Mature stems of derris a year or more old are brownish in color and are not in a succulent stage of growth. These are the most satisfactory source of cuttings which will root more quickly than immature soft cuttings. In Puerto Rico, derris plants make many flushes of growth each year, but the new growing tips are not a good source of propagating material. Cuttings from mature stems have rooted well, however, regardless of the season.

Derris transplants in this experimental field were watered and were protected from the sun and low humidity of the dry season by individual paper cups. Although this may not be practical on a large scale, the method resulted in more than 98 percent survival and demonstrated that derris will survive adverse conditions if given proper care. The practice would not be necessary in the rainy season.

The size as well as maturity of derris stems is important for proper rooting. Experiments have demonstrated that cuttings made from stems .78 of an inch or larger in diameter result in a better "take" than those .4 or less. Large-diameter cuttings have a proportionately greater storage of carbohydrates, which induces stronger and definitely larger roots to develop during the early stages of rooting, and they possess sufficient reserves to live through conditions that often kill small cuttings. Although the cuttings of smaller diameters usually root, they do not always possess sufficient vigor to withstand adverse conditions such as excessively hot or dry weather. Large cuttings are generally ready for transplanting within 3 months, whereas small cuttings require 4 months or more in the nursery bed. Rufus H. Moore, however, reports in a Circular (No. 24) from the Mayagüez Experiment Station that the quantity of roots produced by the end of 2 years apparently is not affected significantly by the original cutting size. Small-diameter cuttings, therefore, may be safely used in the field once they are well rooted, but they should be placed in a separate nursery bed because they will not be ready for transplanting as soon as the larger ones.

Handling Derris Shipments

Stems are removed from the field plants in convenient 3- to 4-foot lengths, and those not in immediate use should

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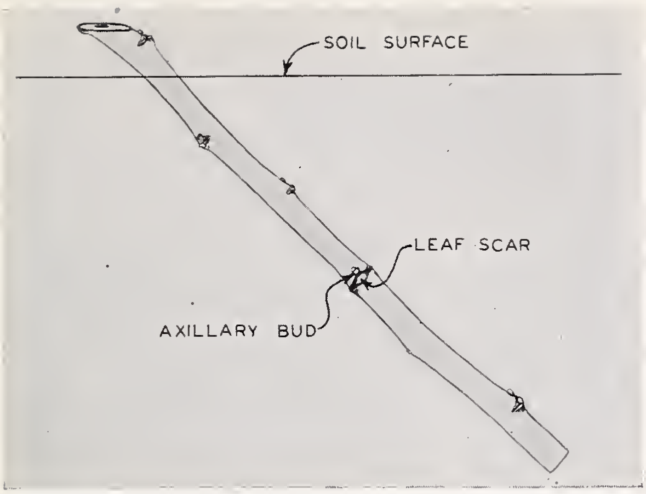
* *See* "Derris Grows in America," by Rufus H. Moore, *Agriculture in the Americas,* January 1945.



Derris cutting properly placed at a 45° angle in the nursery bed. The sloping cut at the top of the cutting indicates the upper end.

be kept well covered with wet burlap bags. The stems, from which the leaves have been removed, are usually packed in bundles of 600, each stem being 3 feet in length. The bundles are wrapped in damp sphagnum moss with an outer covering of waxed paper. As a further precaution against drying, both ends are dipped into melted paraffin to a depth of about 1 inch. Cutting material shipped in this manner usually will root satisfactorily even after 4 or 5 weeks in the package. Arrangements should be made, however, to plant shortly after arrival because en route they may have been subjected to extreme temperatures or other unfavorable conditions. Upon receipt of a shipment, the bundles should be opened immediately and the cuttings spread out in a cool damp place where they can be covered with wet burlap bags.

The Cuttings

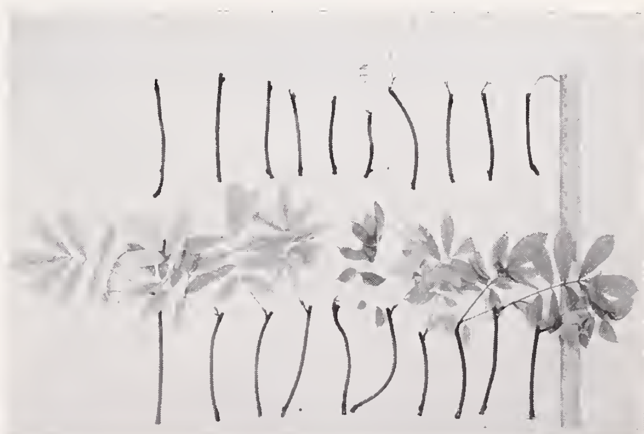
Cuttings are made from the stems just before planting. First, the paraffined ends are cut off and discarded. Ordinary pruning shears are convenient for preparing the cuttings, which are usually made 8 to 12 inches in length, and the work should be done in the shade. Longer cuttings are necessary if the stem is small, .4 of an inch or less in diameter. Each cutting should have at least 2 buds, or nodes. It is also important that the basal cut be made at least 1.2 inches below a leaf scar or node on each cutting because the first roots develop from the base of the cuttings and relatively few roots arise above the base. The reason is that the tissues in the neighborhood of a node are not anatomically suited for producing roots; hence, if a cut is made across the node, relatively few roots arise. The cut at the top, or distal, end of each cutting should be made about .4 of an inch or more above a bud in order to prevent the bud from drying. Top growth will begin from this upper bud. In all instances, scientists at Mayagüez believe, it is important that the cuttings should be prepared and planted in a nursery bed without delay. For this reason, nursery beds should be made in advance of the arrival of the derris shipments.

Nursery Beds

Derris cuttings root well in soils ranging from coarse sand to heavy clays. More stocky roots develop from cuttings planted in sand or sandy loam. On the other hand, clay types of soil have the advantage that they can be made into raised nursery beds which hold their shape better than beds of the lighter-soil types and retain more soil moisture. Probably the type of soil which is most convenient is the best to use in the nursery bed, although one must remember that a plentiful supply of water is needed for beds of a sandy type. Derris cuttings rooted in sand confined by board frames cannot be left indefinitely because sufficient nutrients are not present for sustaining good plant growth.

In Puerto Rico, a simplified method of preparing nursery beds has been devised. Ridges 8 inches high, 18 inches wide, and spaced 4 feet from center to center, are made with plow and hoes. Beds of this type are necessary to provide drainage during rainy seasons.

For planting, the nursery beds are opened transversely with a hoe, and 8 or 10 cuttings are placed 2 inches apart in rows which, in turn, are spaced 6 inches apart. Cuttings are placed on a slant, to reduce the depth necessary to dig for transplanting, and experiments have shown that the angle is of no importance so long as the cuttings are covered sufficiently to be kept moist. The top bud must be above the soil surface at least an inch and directed up, away from the soil; otherwise, growth of the shoots is delayed, William C. Cooper states in his article entitled "Insecticidal Crop Investigations."



It is important that the distal (top) buds of derris cuttings be directed up toward the light and not toward the rooting medium. These experimental cuttings included only 2 nodes and were planted in a sand bed at an angle of 45°. The upper row of cuttings had the top buds directed down toward the sand; the lower row had the top buds directed upward. The picture was made 42 days after the cuttings had been set in the sand bed.

The mistake is easily made of placing the basal ends up and having the distal, or top, ends buried. Cuttings of plants rarely root satisfactorily if they are placed in the soil upside down. This error is caused partly by lack of supervision of unskilled labor and partly by the difficulty of recognizing which end of a cutting is the one to be left above ground. Fortunately, there is a small dormant bud present in the axil of each leaf, or above the leaf scar, which is flanked by two stipules. Thus, the top end of a cutting will be the end directly beyond the axillary buds. A convenient method of marking cuttings for unskilled labor is to make the top cut sloping and the basal cut square. In all cases close supervision of the planting is an important factor.

If nurseries are planted during the dry season, they grow better with partial shade at first and frequent irrigation. Palm leaves suspended on a bamboo framework over the beds make an excellent shade. Those planted during rainy periods need neither shade nor irrigation and, therefore, are the simplest to manage. Weeding is necessarily done by hand and is particularly important during the first few weeks while the cuttings are becoming established.

Transplanting to the Field

About 6 weeks are required for .4-inch-diameter cuttings to develop sufficient roots for transplanting to the field. The roots should be 5 to 6 inches or more in length and relatively abundant. Studies have shown that root and top development are opposing phenomena in the early stages of growth of derris cuttings. Thus a plant with a comparatively large top may have developed relatively few roots, and a cutting with little or no top growth may have developed many roots. This relationship becomes more balanced with time, however, and, if the cuttings have produced strong roots, they may be planted with reasonable assurance of success regardless of the top. If cuttings are left in the nursery bed until considerable vine growth has developed, the top shoots should be cut back to stumps approximately 6 inches in length before they are transplanted.

Survival after transplanting to the field is practically assured if performed during the rainy season on well-prepared soil. Transplanting can also be done successfully during the dry season provided shading and irrigation are practiced. In either case, the field should be plowed and disked before furrows are opened 4 inches deep and 3 feet apart. Rooted cuttings are dug from the nursery bed with as little disturbance to the roots as possible and planted at about the same depth 2 feet apart in the row. If these simple rules are followed, derris is an easy plant to propagate.

MEXCALA-BALSAS

(Continued from back cover)

Cities

A number of important cities lie within the Balsas River Basin. Tlaxcala is the capital and principal city in the State of Tlaxcala. Puebla, the capital of the State of Puebla, is one of the most important commercial centers in Mexico. Cuernavaca, in the State of Morelos, is the capital of that State and a popular health resort. In the State of Michoacán, Morelia is the capital and principal city, as well as the birthplace of Morelos, one of Mexico's national heroes. At Iguala, in the State of Guerrero, the "Plan of Iguala," asserting Mexican liberty, was announced. Although not within the Balsas River Basin proper, Acapulco, in the State of Guerrero, is important to the economy of the area. Acapulco is an important seaport and has one of the finest natural harbors on Mexico's Pacific coast.

Nature of the Area

The Balsas River Basin encompasses an area of about 65,000 square miles, a region dominated by mountains. For a distance of 75 miles from the mouth of the river, the basin remains near sea level. Then it becomes mountainous, rising in the northern, southcentral, and southeast regions to as much as 13,000 feet.

The Volcanic Axis (*Eje Volcánico*) of Mexico lies within the river basin in the State of Michoacán. The new and widely publicized volcano, Paricutín, which came into existence early in 1943, and the volcano, Jurullo, which first erupted during the eighteenth century, are located in that State. The well-known volcanoes, Popocatepetl and Ixtacihuatl, which rise over 16,000 feet above sea level, are also located within the Balsas River Basin. They lie in the Sierra Nevada in the northern part of the basin near the border line of the State of Mexico.

Soils within the Balsas River Basin are rich. Prairie grasslands are found in the lower levels. Chestnut soils cover a large area along the river banks near sea level. Black soils dominate the higher elevations beyond the prairie grasslands and are especially prominent in the northern and eastern parts.

Agriculture in the Basin

More than three and a half million people live within the Balsas River Basin—slightly more than 18 percent of Mexico's population. The great majority of these people are engaged in agriculture.

Cattle and hogs are raised throughout the region. The State of Michoacán is one of the five leading cattle-producing States in Mexico.

A wide variety of crops thrives in the basin. Corn and beans are produced in every State. Sugarcane, while grown in other areas, is produced in greatest quantity in the States of Puebla and Morelos. Cortez is said to have established Mexico's first sugarcane plantation and sugar mill in the State of Morelos. Sesame is an important crop in the basin, with the State of Guerrero the leading producer. At Iguala, in that State, are located some of the most important sesame- and copra-crushing plants. Many kinds of fruit are also grown in the basin. Some of the principal fruits include oranges, limes, mangoes, watermelons, cantaloupes, bananas, and avocados, grown

(Continued on page 157)

ALONG THE *Agricultural Front*

▲ Agricultural Students Form International Society

Agricultural students from Brazil, Chile, Colombia, Ecuador, Haiti, Jamaica, and Venezuela who are studying extension methods in this country have organized an international association which will permit them to continue exchanging ideas, experiences, and results after they have returned to their own countries. These contacts will be continued through reports, personal letters, visits, and the exchange of publications.

The president and secretary of the new group, which is known as the International Society for Studies in Extension Work, are both from Colombia. They are Alvaro Chaparro, Professor of Agriculture, Cali, president; and Antonio Penate, Extension Agronomist, Ministry of Agriculture, Medellín, secretary.

Organization of the society climaxed a year's study of extension methods and farm practices in this country by 25 students under scholarships provided by the U. S. Department of State and the Office of Inter-American Affairs. The training program is administered jointly by the Extension Service of the War Food Administration and the OIAA.

In commenting on the new organization, M. L. Wilson, Extension Director, pointed out that "the students, in forming the international society, have taken a progressive step toward achieving one of the goals of the training program: the development or expansion of agricultural extension work in other countries as a means of improving production practices, and diet, health, and living standards in rural areas."

Other objectives of the new organization include establishing contact with future extension workers of the various countries, keeping informed concerning the progress of the extension service in the United States and in other countries, and facilitating opportunities for contact between rural youth and adults of the various countries.

Honorary membership in the society has been conferred on M. L. Wilson, Director, and Gladys Gallup, Fred Frutchey, M. C. Wilson, Barnard Joy, and C. B. Smith, all of the Extension Service; P. K. Hooker, Office of Inter-American Affairs; Ross Moore and Ralph Allee, of the Office of Foreign Agricultural Relations; and R. L. Zwemer, of the Department of State.

▲ Canada Publishes New Agricultural Magazine

A copy of the new publication, *Agriculture Abroad,* published by The Economic Division, Marketing Service, Canadian Department of Agriculture, was recently received in the office of *Agriculture in the Americas.* Our congratulations to Editor L. Lorinez for an informative and timely publication!

The new magazine endeavors to present to the Canadian farmer "current information pertaining to agriculture in other lands." According to the foreword, it will contain "A Digest of Agricultural Policies in effect or under consideration in various countries."

Some of the more important topics discussed in the first issue are 1945 Production Plans, Readjustment Planning, the U.S.S.R. in World Trade, the United Nations Food and Agriculture Organization, International Cooperation of Farm Organizations, and agricultural policies in the United States, Great Britain, Russia, and other foreign countries.

For the present, *Agriculture Abroad* is planned as a quarterly. Its circulation will be limited to those who request it.

▲ Guatemalan Station Expands Activities

Through a supplemental memorandum of understanding the United States and Guatemala have agreed to extend activities of the Agricultural Experiment Station in the latter country to include all complementary crops. Originally the memorandum of understanding provided for the operation of an Agricultural Experiment Station primarily for cinchona experimentation. Under the program the Government of Guatemala has made available to the Station the lands and resources of three large farms, Chocolá, Monterrey, and Palo Gordo.

MEXCALA-BALSAS

(Continued from page 156)

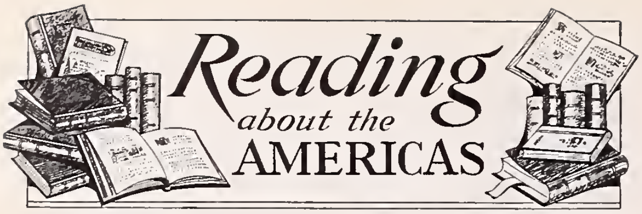
in the sub-tropical and tropical areas; peaches, apples, and pears, grown in the higher elevations. Barley, chick-peas, copra, and dried chili are other principal products, in addition to wheat, alfalfa, and rice. Wheat produced in the State of Tlaxcala is believed to be directly descended from the first wheat grown in Mexico, introduced by Cortez.

Although mining occupies a relatively unimportant place in the economy of the basin, there are a number of important mineral deposits. These include gold, silver, lead, mercury, copper, iron, zinc, alabaster, marble, alum, coal, and sulfur. Like mining, manufacturing is of much less importance than agriculture. Some forests exist in most parts of the basin. Lack of adequate transportation, however, has prevented more than local utilization of these timber resources.

Transportation

Transportation is perhaps the most pressing need of the basin. The Balsas River itself is navigable by boats of small draught for only about 62 miles from its mouth. The river and its tributaries are, for the most part, navigable for motor boats, canoes, and other small craft. Other transportation facilities, including both railroads and highways, are largely concentrated in the northern part. The most important highway extends from Mexico City into the basin and runs south through Cuernavaca and Iguala to the Pacific coast port of Acapulco.

The difficult mountainous terrain so characteristic of the Balsas River Basin discourages extensive construction of both railroads and highways. However, if a network of roads and railroads were built, and if some of the waterfalls of the Balsas and its tributaries could be utilized for power, the way would be opened for full development of the agricultural, forest, and mineral resources of the Balsas Basin.



El lino oleaginoso, (Flax as an oilseed) by Raúl Ramella. 206 pp., charts and tables. Editorial Sudamericana, Buenos Aires, Argentina, 1944. This is No. 26 of the Argentine Crop and Livestock Encyclopedia. The author discusses in Spanish, quite technically, the cultivation, manufacture, and economics of flaxseed in Argentina. The five sections of the book deal with: History of flax, starting with Egypt; the plant; its cultivation; the industry; flax in economy.

A List of Related Spanish-English Words, prepared by Marshall E. Nunn. 40 pp. Bureau of Business Research, School of Commerce and Business Administration, University of Alabama, University, Alabama, 1944. This is a list of about 2,000 related Spanish-English words taken largely from contemporary Spanish-American newspapers. In the introduction the author explains his use of the term cognates as "pairs of words in Spanish and English which are closely similar in spelling and meaning," and points out the relationship of word endings in the two languages, as, for instance, *organización* in Spanish, organization in English, and *unidad,* unity. A separate list of false cognates is included.

La agricultura de la costa y la situación alimenticia, by Ing. Agr. Gerardo Klinge. 76 pp., tables and charts. Sociedad Nacional Agraria, Lima, Peru, 1944. This is an economic study of the agriculture of the coast of Peru and of the food situation in that country. Special attention is paid to comparative studies of the production of cotton, sugarcane, and rice. These studies were published in *La Prensa* of Lima between October 1943 and January 1944.

A Padre Views South America, by Peter Masten Dunne, S.J. 290 pp., illus. The Bruce Publishing Company, Milwaukee, Wisconsin, 1945. This is, in effect, a travelogue, filled with colorful descriptions of the churches, educational buildings, customs, crops, and scenes which the author visited during a sabbatical year of travel in South America, ending in July 1944. The author, who is Chairman of the Department of History in the University of San Francisco, traveled through parts of Southeastern Brazil and of all the other countries of South America. With the background of many years of study of and personal acquaintance with the people of South America, he "discusses the why and wherefore of their emotions, customs, religion, education, even their reaction to international problems."

EDITOR'S NOTE.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

AGRICULTURE IN THE AMERICAS — O. R. CARRINGTON, EDITOR

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Gifts of the Americas

COPAIBA

by MARY S. COINER

Among the varied gifts of the Americas is oleoresin of copaiba, which has lent itself to use in several industries and in the medical profession. Though not widely known, resin of copaiba is used as a fixative in scenting soaps and perfumes, as an ingredient of varnishes, and in photography to emphasize halftones and shadows. From early times it has been known as an antiseptic and healer.

Oleoresin of copaiba is obtained from trees of the genus *Copaifera*, family Leguminosae, which are indigenous to northern South America. They grow wild in the jungles of the Amazon Basin of Brazil, extending into Venezuela, Colombia, and the Guianas in the north and as far south as Rio de Janeiro. The trees grow to medium size, with smooth bark, oval translucent leaves, and small white flowers. The fruit is a one-seeded legume.

Native woodsmen, financed by exporters in some port, travel by canoe or on foot into remote regions of the jungle to tap the trees, often staying several months. Several feet above the ground, they make vertical incisions or drill holes, one above another, reaching to the center of the trunk. Ducts within the trunk enlarge and join, forming cavities where the resin accumulates. Occasionally the trees are so rich in resin that the ducts burst of their own accord and the juice exudes from these openings. A single tree may yield 10 or 11 gallons, the yield depending upon the botanical variety, age, climatic conditions, and length of time since the tree was last tapped. The greatest yield is obtained in the dry season, but tapping may be done througout the year.

Copaiba as it flows from the tree is clear, pale in color, and very thin, but upon exposure it becomes thicker and acquires a definitely yellow tinge. It has a slightly greenish fluorescence, a peculiar aromatic odor, and a persistent, bitter taste. It is partly soluble in alcohol and almost completely soluble in dehydrated alcohol, carbon disulfide, chloroform, and ether, but is insoluble in water.

At trading centers the woodsmen sell their resin to intermediaries or barter it for food and other necessities. It is then shipped down river to a port, the most important ports being Pará or Manaos in Brazil, or Maracaibo in Venezuela. Exporters remove such foreign matter as water, particles of bark, and leaves, sort the lots according to solubility and color, and export them as balsam of copaiba. In 1939 Brazil exported 172 short tons—122 tons to the United States, 26 to Japan, and 15 to Great Britain.

After the balsam reaches foreign markets, the oil is distilled. It is a liquid, transparent, and somewhat opalescent resin-oil. It is sometimes colorless but may vary in color from pale yellow to golden brown. Commercially, balsams from Pará and from Maracaibo are the most important, the former being preferred for the distillation of oil, since it yields up to 85 percent. The latter has thicker consistency and yields from 35 to 58 percent of oil.

The Indians applied copaiba oil as a healing balsam for sores and ulcers and against tetanus. Early Portuguese colonists discovered still other healing qualities in it, some of which science has confirmed. It has been known in Europe since the beginning of the sixteenth century. In England it was first recorded in a work published by Purchas, the historian, in 1625 and was introduced into the London Pharmacopoeia of 1677. In 1820 it was introduced into the United States Pharmacopoeia.

Taken internally in the form of capsules, copaiba produces a sense of heat in the throat and stomach and extends an irritant action throughout the alimentary canal. It serves as a diuretic, laxative, and, in large doses, often as a purgative. The oil is used in treating chronic inflammations of the mucous membranes, such as chronic cystitis and bronchitis, and as an emollient in treating certain diseases.

Several botanical species of the trees which produce balsam of copaiba are found in different parts of the continent. The resin is known, not by the species which has produced it, but by the port from which it is shipped. The greater part of Brazil's copaiba comes from *Copaifera reticulata* and is known in trade as Pará copaiba. Maracaibo copaiba, a variety distinguished by greater viscosity and darker color than Pará copaiba, comes from *C. officinalis*, which is a native of Venezuela, and from *C. guianensis*. These species are found also in Colombia and the Islands of Trinidad and Martinique. *C. multijuga*, the *Copahiba Angelim* of the States of Pará and Mato Grosso, is the source of the greater part of the commercial balsam exported from Manaos.

MEXCALA-BALSAS RIVER BASIN—MEXICO

by **Beatrice Du Frane**

By its very name, the Río Balsas of southwestern Mexico—the River of the Pools—partially describes itself, for in its slightly more than 420-mile course to the Pacific Ocean the river forms numerous whirlpools. It cascades over waterfalls and churns up rapids. In some places the river runs swift and shallow; in others it flows wide and deep.

Not only does the Balsas run a capricious course from the mountains westward to the sea, but it also assumes various names. In some areas the river is known as the Río Mexcala, in others as the Río Atoyac. The Balsas is the largest river in southwestern Mexico and one of the largest in the entire country.

Rising in the Tlaxco mountains north of the town of the same name, in the State of Tlaxcala, the Balsas flows through the State of Puebla from north to south and enters the State of Guerrero on the east, flowing across this State and forming the boundary line between the States of Guerrero and Michoacán. Many of the rivers and streams in the States of Tlaxcala, Morelos, Puebla, Guerrero, and Michoacán empty into the Balsas. Feeder streams are most numerous in the northern part of the basin, near the headwaters of the river. The Balsas empties into the Pacific Ocean at Zacatula, Guerrero.

Climate

The climate in the basin varies from hot in the lower reaches to cold around the outer fringes and in the higher elevations. The State of Tlaxcala, for example, boasts a healthfully temperate climate, with moderate rainfall during the rainy season. The southern and central areas of the State of Morelos are hot, averaging 82°F.; the mountainous northern area is temperate or cold. Rainfall is abundant, averaging 100 inches annually. The State of Puebla, too, has a varied climate. For example, Chiautla, in the southwestern part of the State, is hot, with a mean temperature of about 73°F., while the higher elevations in the State have a temperate climate averaging 55°F. Rainfall varies according to elevation. Heat is intense along the coasts of the States of Guerrero and Michoacán and rainfall is torrential during the rainy season. In the higher elevations the climate is temperate or cold and rainfall is moderate.

(Continued on page 156)

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Agriculture in the Americas

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NAMES & NEWS

Brazilian Health Expert Visits the United States

Dr. Luis de Mendonca e Silva, of the Health Department in the Federal District of Rio de Janeiro, Brazil, is in the United States as a guest of the U. S. Department of Agriculture and the Office of Inter-American Affairs. He is particularly interested in the work in nutrition being carried on by the Department of Agriculture.

●

Jamaican Studies Cattle Breeding

D. A. R. Campbell, Agricultural Officer of the Jamaican Government, recently completed a course of special training in artificial breeding of cattle and related problems at Cornell University. Mr. Campbell came to the United States under the auspices of the Anglo-American Caribbean Commission.

●

Assigned to Cooperative Rubber Experiment Station

Mortier F. Barrus, of the Bureau of Plant Industry, Soils, and Agricultural Engineering, has recently been assigned to the staff of the Cooperative Rubber Experiment Station at Turrialba, Costa Rica. He will assist with the development of small-farm rubber plantings, contacting farmers, cooperators, and the various government credit and agricultural agencies participating in the program.

●

Goes to El Salvador

Glen L. Taggart, Social Scientist, Office of Foreign Agricultural Relations, is in El Salvador conducting a series of studies to aid in promoting an extension program in that country. Special attention will be given to cultural factors as they pertain to the successful operation of the program for training nationals in various phases of technical agriculture.

Dr. Swingle in Peru

Charles F. Swingle, Horticulturist, Office of Foreign Agricultural Relations, left Washington recently for Tingo María, Peru, where he will serve as horticulturist at the Cooperative Agricultural Experiment Station. Dr. Swingle will remain in Peru indefinitely.

●

Brazilian Visitor

Sr. Josue A. Deslandes, Brazilian agronomist, recently arrived in this country as a guest of the Department of State. He is especially interested in plant pathology and will take courses in agriculture at Iowa State College.

●

To Inspect Rubber Projects

Gordon Whaley, Rubber Plant Investigations, of the Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, is visiting seven Latin American countries to inspect plantings and research projects being carried on under the Cooperative Investigations Program. Dr. Whaley will be gone until the middle of November and will visit Guatemala, Costa Rica, Canal Zone, Panama, Colombia, Haiti, and Dominican Republic.

●

School-Workshop Director Visits U. S.

The Reverend Father Rafael Eugenio, Director of the School-Workshop for Rural Students in the State of Tachira, Venezuela, is in the United States, as a guest of the Department of State. He is planning to visit various rural schools, cooperatives, and demonstration farms, and confer with government and educational officials. His itinerary also includes a visit to Father Flanagan's Boys' Town near Omaha, Nebraska.

Father Eugenio's School-Workshop, founded in 1940, is located in a region of mountain farmers who for the most part own small truck farms ranging from 1 to 5 acres in extent. The School-Workshop averages about 100 students, who learn everything from how to make bricks to crop improvement. Many of the students take up extension work and teaching after they graduate.

Agriculture IN THE *Americas*

Vol. V · SEPTEMBER 1945 · *No. 9*

Tingo María, Dedicated to Better Agriculture

Dedication of the newly completed experiment station in the foothills of Peru's Andes Mountains this summer marked a definite forward step for the betterment of agriculture in the Western Hemisphere.

by QUINCY EWING

Assembling in the beautiful valley of the Huallaga River, in the eastern foothills of the Andes Mountains, 2,300 feet above sea level, government officials of the American republics, scientists, and farmers joined, from June 28 to July 4, in formal ceremonies dedicating the Cooperative Agricultural Experiment Station at Tingo María, Peru, to the economic welfare and social advancement of the people of the Western Hemisphere. At the same time the fourth regional meeting of the Peruvian National Society of *Ingenieros Agrónomos* was held.

Distinguished speakers paid tribute to the agricultural leaders of Peru and the United States whose ideal of international agricultural cooperation has at last become a living, functioning reality at the research and extension center. The Tingo María Station has developed as an expression of international friendship and cooperation and as a center of mutually beneficial inter-American action. The hemispheric good neighbor spirit which made this possible was much in evidence during the dedication.

But the dedication was more than an occasion for bestowing deserved praise on those responsible for Tingo María's establishment. In a broader sense it was a formal recognition of the fact that, agriculturally and economically, Americans have turned their backs upon the past.

This truth was underscored in addresses by Ing. Godofredo A. Labarthe, Peruvian Minister of Agriculture, by Dr. Ross E. Moore, of the Department of Agriculture's Office of Foreign Relations, and by other high government officials. These speakers pointed to Tingo María as evidence of the fact that the people of the Western Hemisphere have determined no longer to look with complacency upon great expanses ot relatively unfarmed tropics,

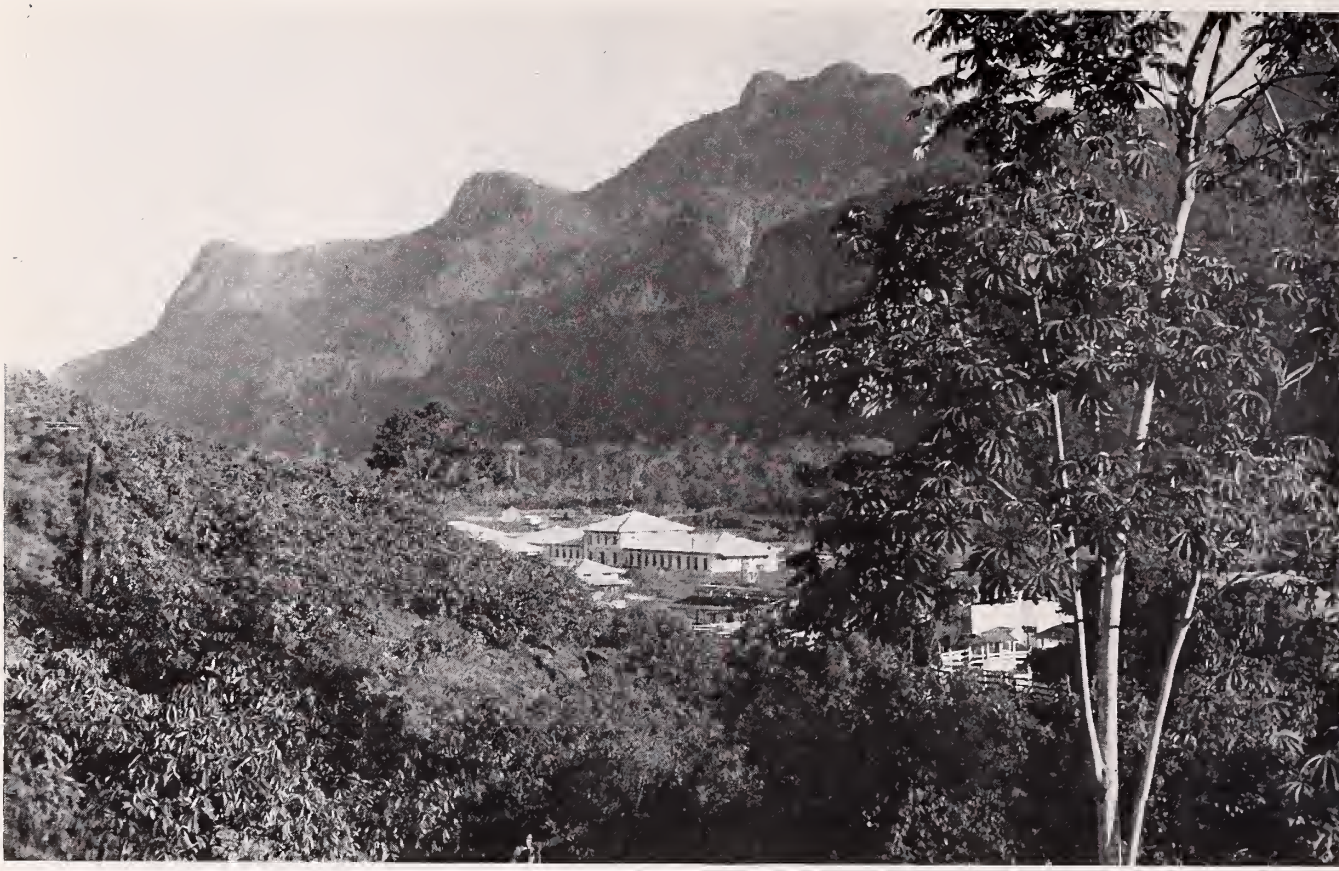
Ing. Manuel Prado U., President of Peru, addresses the opening session of the *Ingenieros Agrónomos.*

but rather to develop to the fullest their agricultural and economic resources. Then only will there be abundant hemispheric production for all and, consequently, a higher level of consumption for all.

Mr. Ewing is an Information Specialist on the staff of the Office of Foreign Agricultural Relations.

Visitors Laud Project

More than 200 persons, many of whom traveled far to be present, attended the ceremonies. Guest of Honor



Tingo María is located in the beautiful Huallaga River Valley in the foothills of the Andes Mountains.

was Ing. Manuel Prado U., President of the Republic of Peru.

Ing. Labarthe, Peru's Minister of Agriculture, paid tribute to Ing. Pedro Recavarren Cisneros, Director of Agriculture for the Peruvian Oriente, to the technical personnel of the Ministry of Agriculture for their important contributions to the institution, and to Dr. Moore for his cooperation and early recognition of the exceptionally desirable location of Tingo María as the site for the Station. Ing. Labarthe stressed the fact that "no one could have a doubt of the economic, social, and technical implications of the research center," and he pointed out that the Peruvian Government, in working to establish the center, had "the task of recovering in 5 years what had been lost over half a century."

Dr. Moore told those present: "The men of science in the Americas, with the driving spirit which characterizes and unites research workers, will pursue at Tingo María a cooperative and coordinated investigation of the principles that will show us the way toward an agricultural-social improvement."

The dedicatory addresses pictured Tingo María as a symbol of the world's development and a center of beneficial and effective action for agricultural betterment. Being the first international cooperative station to be founded in the Americas, it was described as an inspiration to all countries. A parallel was drawn between the international idealism and vision embodied in Tingo María and the spirit that prevailed in the formation of the United Nations Organization at San Francisco.

Speakers praised the pioneering spirit of the men who contributed so much to the origin and establishment of the Station. Among those receiving particular tribute were President Prado; United States Secretary of Commerce, Henry A. Wallace; Dr. David Dasso and Sr. Pedro Beltrán, of Peru, who engaged in negotiations with United States officials leading to the establishment of the Station; Leslie A. Wheeler, Director of the Department of Agriculture's Office of Foreign Relations; and Ing. Recavarren.

During the week spent at the Station, the visitors were visibly impressed by the buildings and equipment of the main station at Tingo María and by the experiments being conducted there. Visits made to the sub-stations in the adjacent region showed the specialized work on tea and cinchona. Research and experimentation had been going on at the Station for some time prior to the dedication.

History of Tingo María

Peru and the United States entered into an agreement for the establishment of the Tingo María Station on April 22, 1942. A Memorandum of Understanding provided for collaboration by the two countries in the field of

agricultural activity by means of experimentation and extension of findings to farmers.

Broadly expressed, the object in establishing this cooperative station as well as those started since in Ecuador, El Salvador, Nicaragua, and Guatemala was twofold. The belief was that by the development in these stations of varieties and strains of rubber, quinine, manila fiber, insecticidal plants, and other complementary products particularly adapted to the tropics of the Western Hemisphere the tropical American countries would be encouraged to go into commercial production of these crops, thereby broadening their economic base and assuring themselves of a more stable and prosperous economic life. At the same time the entire hemisphere would be assured of a stable and plentiful supply of these highly important commodities essential both to the prosecution of successful warfare and to a high standard of living in peacetime.

Heretofore, the United States and the tropical countries themselves had been heavily dependent upon the Far East for imported supplies of all of these products. The necessity of having nearby supplies of these strategic commodities was brought home to us forcibly when, following Pearl Harbor, the Japanese cut off our former sources. Furthermore, although the United States in the past has purchased great quantities of tropical agricultural products, mainly from the Far East, purchases from the other American republics have been relatively slight. As markets expand with the rising level of economic activity toward which all postwar plans are being laid, stations like Tingo María will help the tropical American countries produce more and therefore buy more.

It was before the war, however, that the cooperative program now being carried out at Tingo María was envisioned by far-seeing officials of both the United States and Peru. In 1939 an Inter-Departmental Committee for International Cooperation with the other American republics was formed in Washington, composed of representatives of each Executive Department. Sumner Welles, then Under Secretary of State, was chairman, and Henry A. Wallace, then Secretary of Agriculture, was one of the active supporters. The Committee, as one of its activities, set to work devising ways and means of furthering a program for development of complementary commodity production through research and experimentation.

Group of residences at Tingo María, with truck-crop experimental plots in the foreground.

Most of the meetings were held in the Administration Building, which houses laboratories and offices.

For some years Peru had been planning the establishment of a station such as Tingo María, and Peruvian technical experts and scientists felt the Huallaga River Valley offered the best possible location. After negotiations, the two countries entered into an agreement to share responsibility for the construction and operation of the research center on the basis of their joint interests.

Contributions of the Two Countries

Peru made available lands for conducting investigations and demonstration work. It has constructed a laboratory, office, hospital, library, service buildings, and residences for the Peruvian and United States staff members, and has provided furnishings and equipment obtainable within the country. Other contributions include necessary books and periodicals other than those issued in the United States, funds for Station projects, and the services of associate technicians, clerks, mechanics, and unskilled labor. The Peruvian Government has also taken steps to send students to the United States for graduate work at agricultural colleges so that eventually Tingo María may have a completely Peruvian staff.

The contribution of the United States has been chiefly scientific and advisory. Scientists have been provided to serve as director, agronomist, pathologist, soils scientist, animal husbandman, rubber specialist, agricultural engineer, and agricultural extension specialist at the Station. In addition, visiting technicians have been furnished from time to time in various fields of agricultural science to assist the regular Station staff and the Peruvian Ministry of Agriculture.

(Continued on page 177)

Menthol Comes to the Hemisphere

The menthol which goes into cough drops, various pharmaceuticals, and even some brands of cigarettes, used to come chiefly from Japan. Now Brazil is supplying the menthol needs of the United States and at the same time building a remunerative industry.

by HENRY W. SPIELMAN

In Brazil a new agricultural enterprise has been growing during the past few years. It is the production of menthol, which is exported in the form of crystals extracted from the essential oil of mint which, in turn, has been distilled from the partially dried plant of the Japanese mint.

This industry grew to its present size as a result of the demands of the United States for menthol, the supply of which had been suddenly cut off by the war. For many years prior to the war Japan and parts of Japanese-occupied China supplied most of the menthol so important in pharmaceuticals, oral preparations, and in some brands of cigarettes. In fact, Japan had held a monopoly and was challenged only during the last decade by newly developed synthetic substitutes. In prewar years the United States imported about 500,000 pounds yearly. Practically all of this business was in the hands of Japanese manufacturing trusts, which had been able to control both production and price. The United States was largely dependent upon the Japanese supply. The peppermint oil produced in the United States, *Mentha piperita,* contains only 50 to 55 percent menthol as compared with 70 to 90 percent in the Japanese.

In Brazil most mint is grown on newly cleared woodland.

The Industry in Brazil

Menthol production in Brazil began in 1936, when a few pounds of oil were distilled on an experimental basis. In the 1942-43 season production had increased to 88 short tons of oil, and by the 1943-44 season to approximately 385 tons. Estimates for the 1944-45 season indicate the production of between 440 and 550 tons.

A large part of the menthol production is in the hands of Japanese growers, approximately 200,000 of whom live in the State of São Paulo, where most of the menthol is produced. A large part of these Japanese migrated to Brazil following the Tokyo earthquake of 1923. They are believed to have brought with them from Japan some of the mint plants which have been used for establishing this new industry.

At the present time there are approximately 20 menthol manufacturers in the State of São Paulo. Many of these producers operate home industries and are still struggling to perfect their processes. During the past year a few bankers and wealthy industrialists have gone into the business, have set up modern crystallizing plants, and, because of the uncertainty of obtaining oil from growers during the past two seasons, have gone into the production of their own mint oil. Most of the plants follow the freezing technique for obtaining menthol crystals. The larger menthol manufacturers operate their own export organizations and are represented by agents in the United States. There are also many independent exporters in the cities of São Paulo, Santos, and Rio de Janeiro who purchase their requirements from small local manufacturers and ship the crystals like any other export commodity.

Producing the Crop

The most extensive mint-growing regions in the State of São Paulo, the Brazilian State producing the most menthol, are in the western third of the State. The organic material and moisture content of the soil in this region are

The author is serving as Agricultural Economist, Office of the United States Consulate General, São Paulo, Brazil.

The flowers of the Japanese mint are near-white in color.

well adapted to the production of mint. Other producing regions are along the coast southwest of Santos and around the city of São Paulo.

In the western producing zones, most of the mint fields were planted on newly cleared forest land. Roots can be planted directly in the newly cleared soil, without plowing, soon after the spring rains begin, usually in September and October. When a grower plants mint for the first time, he gets rhizomes from a neighbor or buys them from a nurseryman and plants them in a seedbed. The beds are prepared in the period between June and August so that the runners are ready for transplanting in the southern spring, which means September or October.

For planting, the rhizomes are cut in pieces about 2 inches long, each piece having 3 or 4 knots, and are then placed in shallow holes 15 to 20 inches apart. By the end of 3 or 4 months the plants have put out runners which cover the ground. At the end of the season it is advisable to thin the mint plants, leaving about 25 in a square yard. The roots for planting in another field are obtained from those plants which have been removed.

Generally a mint field will produce its heaviest crops the second year. Production gradually drops off during the third year, and by the fourth year weeds have become so serious a handicap, that plowing-under the crop becomes advisable. Fertile soil, ample and well-distributed rainfall, and plenty of sunlight are, generally speaking, the factors favorable for high yields of oil and high menthol content.

Mint plants are usually cut during the flowering period, as the menthol content is highest during that period. Cutting is done by hand, and the plants are dropped in the field and left to dry and cure for a day or two. If weather conditions are favorable, stalks will grow again so that two or even three cuttings can be obtained in a year. During the past two seasons, however, droughts have retarded the growth so that two cuttings, and in some instances only one, have been possible.

Distilling the Oil

After the mint is cured, the farmer takes it to a still. A typical still consists of two tanks, a copper condenser, and a steam generator. Several stills may be installed in one open shed. The tanks are filled with partially dried mint plants. Steam enters the bottom of the tank, passes up through the plants, and goes on to the condensers carrying the oil with it. Distillation requires about 6 hours. The oil is separated from the water by letting the mixture stand for a short while in a tank and draining off the oil from the top. The crude oil, containing impurities and some water, is put in old gasoline cans and sold, without filtration, to local merchants.

Fully dried plants contain about 2 percent oil, whereas semi-dried plants contain about 1.5 percent. Eighteen or twenty pounds of oil are generally obtained from each distillation, and the remaining material is used for fertilizer. The average yield of oil for an acre is usually figured at about 44 pounds on two cuttings. If three cuttings are made, as much as 66 to 77 pounds may be the yield.

The menthol content of the oil depends upon the time of cutting and upon the weather during the growing season. The more sunlight, the higher is the menthol content, provided the rains have been ample during the growing period. The first cutting, usually in December or January, produces oil with 65 to 75 percent menthol;

Wooden stills are used to extract the mint oil from the dried plants. One boiler supplies sufficient steam for four stills.

the second, in February or March, about 85 percent; and the third cutting, in April or May, 70 to 75 percent. An analysis of 31 samples of crude oil made by the Institute of Technical Research of São Paulo showed that the total menthol content varied from 65 to nearly 89 percent. Of the 31 samples, 23 contained more than 80 percent total menthol.

The color of the oil depends upon the stage of development when the plants are cut and upon the curing process. Oils distilled from plants cut when in flower are golden in color; if they are cut earlier, the color is darker, and, if cut later, it is greenish-yellow. Green plants yield an oil more intense in color than those properly cured.

Extracting the Menthol

Menthol is extracted from Japanese mint oil by a process of freezing. The first attempts at extraction, in Brazil, were made with ice cream freezers. It was then a home industry. Now the larger plants extract menthol in three steps: Formation of menthol crystals by freezing the complete oil, removal of the crystals by centrifugal force, and drying the crystals. Before freezing, the oil is filtered to remove impurities and cooled to facilitate the removal of water. Some manufacturers use supercentrifuges, machines having extra high centrifugal force, to remove the impurities and water, while others rectify it in vacuum stills. The latter process is more desirable, because in vacuum stills the crystals are more easily formed, possess a finer odor and flavor, and do not contain bitter-tasting high-boiling constituents. Another advantage is that the remaining oil can be sold as rectified dementholized oil at a higher price.

Three steps are usually followed in the freezing process, but each manufacturer has his own ideas about the exact temperatures. The first step is usually to reduce the temperature to about 14° C.; the second, to 10° C.; and the third, to –5° C. Crystals form during each step. The crystal yield is about 50 percent of the weight of the oil.

Japanese mint frequently is grown between tung trees.

After the dementholized oil has been poured off from the crystals, they are put through a high-speed centrifuge to remove all the oil left sticking to them. Some manufacturers wash the crystals by putting small amounts of water in the centrifuge. For drying, the crystals are spread on trays and placed in special rooms for about 36 hours, where warm air, about 26° C., circulates over them slowly. This operation must be done carefully, as a fast air current or too-high temperature will result in considerable loss of menthol by evaporation. Insufficient drying, on the other hand, leaves the crystals too wet. When thoroughly dried, the crystals are sealed in cans for export.

Present Situation

During the first 3 years of menthol production in Brazil many manufacturers were attracted by the high prices of the product and the exceptionally large profits that could be made. Encouraged by orders for 330 short tons of menthol, representing some 660 tons of oil, growers greatly expanded their acreage for the crop which would be harvested from December 1943 to May 1944. This quantity was probably too much to expect, when the production the year before had been only 88 tons of crystals.

Total production of the 1943-44 crop actually amounted to about 385 short tons of oil, 200 tons of menthol. Most of this amount went to the United States. Recent estimates indicate that the 1944-45 crop may amount to between 440 and 550 short tons of oil, or between 220 and 275 tons of crystals. Although the acreage for the present season was somewhat larger than the year before, the yield per acre for the 1944-45 harvest will probably be lower because of the droughts during the first months of the growing season.

Recently the trend has been toward concentrating menthol production in the hands of a few well-organized manufacturers who produce a dependable, uniform product. Several of these manufacturers have started their own plantations of mint so that they can have their own oil supply. These producers hope to hold the United States market after the war, even in face of more cheaply produced menthol from the Far East.

September is the month in which two great universities were founded in the other Americas. In 1551, the founding of the University of Mexico was authorized by a royal cedula by Charles I. This institution opened its doors in 1553. In 1721, the founding of the University of Havana, Cuba, was authorized by Pope Innocent XIII.

●

In September 1790, the great Aztec calendar stone, which was carved from a single block of basaltic porphyry and weighs 25 tons, was excavated in Mexico City. It is now in the Mexican National Museum.

Courtesy of Pan American Union

Glaciers are found on the Equator in the high Andes of Ecuador and Colombia.

Highlights of South American Weather

Man cannot learn too much about the weather if he is going to make it work for him rather than against him. Especially is this true in South America, where development of land resources is being emphasized.

by R. L. DAY

South America is a continent possessing such vast natural resources that it apparently could support a population much greater than that of today. To realize fully the tremendous possibilities in the future development of these resources, however, man must have the weather as an ally, not a foe. A knowledge of the outstanding features which make South American weather so distinct from that of other parts of the world may be of value to those who would share in the development of that great continent or even understand its problems.

Strong Contrasts in Equatorial Section

In South America, which is widest near the latitude of the Equator, is a vast land area within the range of a true equatorial climate. The Amazon Basin forms the major portion of this area. Here the heat is constant and humidity is high, but the temperature is lower than in

corresponding portions of Africa and Australia because of greater cloudiness, heavier rainfall, and denser and more extensive forests. North of about 20° S. lat. there are no passing "highs and lows." The weather is monotonously the same, day after day, the only changes being seasonal—those variations that occur with the passing of the wet and dry seasons.

The extremes of heat in the equatorial section are much less than in the lowlands of northern Argentina, 108° F. being the highest temperature observed in interior sections, and readings in the 90's (°F.) being the limit at many coastal points. By contrast, 122° F. has been registered in northern Argentina, near the Chaco, and 110° to 120° F. has been observed at many places in that country. The high humidity in the lowland of northern South America may become extremely enervating, especially in the interior regions out of reach of cooling ocean breezes.

In the high Andes of northwestern South America in the same latitude, on the other hand, is the largest area in the world with temperate and even arctic climate lying within equatorial latitudes. Glaciers are present in the high Andes of Ecuador and Colombia, directly on the Equator. These glaciers build up from the almost daily fall of snow which occurs on the high peaks.

Unusual Weather Conditions in Great Andean Range

Weather conditions of special interest exist through much of the great Andes Mountain range, extending the entire length of the western part of South America. Some of the most unusual conditions are found in that portion of the range lying between southern Peru and central Chile. Included in this section is the high barren plateau, or *puna,* which lies between the two cordilleras of this range in Bolivia and northwestern Argentina.

Courtesy of Pan American Union

The desert region of Chile produces large quantities of natural nitrate.

Courtesy of Pan American Union

Heavy rainfall, sometimes more than 300 inches per year, is responsible for the dense foliage of the tropical jungle.

During the dry season, the southern winter in Peru and Bolivia and the southern summer in Chile, extraordinary ranges of temperature occur within a day. At Santa Lucía, 15,500 feet above the sea, and at Vincocaya, 14,360 feet high, in southern Peru the temperature in the dry season sometimes rises from near 0° in the early morning to about 60° F. in the afternoon. The rays of the sun in these high altitudes are so intense that by day a person may suffer from the heat and yet freeze at night.

The high deserts of Bolivia are lost in mirage by day, during the dry season, and "dust devils," or dust whirlwinds, are frequently seen. At night, however, the air clears and there is bright starlight from horizon to horizon.

Late in the dry season, one often sees fine displays of distant lightning in several directions at the same time just after dark on the *puna* of northwestern Bolivia. Violent afternoon thunderstorms accompanied by rain, hail, and snow become increasingly frequent as the rainy season sets in. Although the temperature may be near 60° F. before the sudden showers break, it drops almost immediately to 40°. The air is brilliantly clear except during these brief violent disturbances. Hence, the cloud forms connected with these dramatic atmospheric conditions are particularly impressive in their beauty.

One of the driest regions in the world is found in extreme northern Chile, just west of the Andes. The rainfall average is 0.02 to 0.04 inch a year, but rain actually falls only in a light shower once in many years. Here is found the world's greatest store of mineral nitrates. These deposits of soluble nitrate of soda have been slowly col-

lecting during the centuries. A few decades of even moderate rains would remove them all, scientists tell us.

Farther south, in central Chile, the contrast between summer and winter is great. The summer is dry and the snow line recedes to an exceptional altitude. Sometimes a man can climb to the summit of Aconcagua, the highest mountain in South America, at nearly 23,000 feet without setting foot on snow. Yet in winter terrific blizzards rage down to altitudes as low as 6,000 or 7,000 feet. The mining town, El Teniente, altitude 7,000 feet, in about the latitude of Santiago, had 432 inches of snow in 40 days in 1926, with up to 54 inches in a single 24-hour period at the height of the storm. In the high valleys, above 10,000 feet, the cold is so intense and the wind so violent that no man can live unprotected from the storm.

By contrast, the nearby Central Valley of Chile, where a large part of the population, industry, and agriculture of Chile is situated, enjoys one of the most healthful climates of South America. It is like the climate of the Mediterranean countries and of southern California. Sunshine is abundant most of the year, interrupted by only moderate storms of rain and perhaps wind in winter. Summer days are warm, but the nights are always cool. Irrigation makes intensive agriculture possible in the fertile soil in spite of the almost complete lack of rain during the summer months.

Another extremely favorable climate is found in the valleys at moderate altitudes between the cordilleras of the Andes in Colombia. An example is Medellín, which, at an elevation of a little over 5,000 feet, has a mean temperature of between 69° and 72° F. in all months. Travelers describe the climate as ideal. The only objection that might be found is the constancy of the temperature.

Storm Patterns in North and South America

Violent storms of wind and rain sometimes lash the southern Chilean coast and Tierra del Fuego. At times in winter, cool waves, known as *friagens,* sweep northward, east of the Andes, almost to the Amazon. As the cool waves move across the *pampas* of eastern Argentina, their arrival is marked by the well-known *pampero.* This is a period of squalls, showers, and violent thunderstorms which may produce impressive displays of lightning.

From the snow-covered mountains, which often rise above the clouds, come the waters for irrigating much of South America's farm land.

In general, however, there is much less variation in the day-to-day appearance of the weather map throughout northern South America than in corresponding latitudes in North America. Nearly all cyclonic effects are produced by a trough line of low pressure extending northward or northwestward from deep disturbances centered to the south—from south of Cape Horn and the Falkland Islands, in 55° to 65° S. lat., to the Argentine *pampas*. Occasionally in winter a shallow depression lies near the central or southern coast of Chile. Even less frequently, a well-defined cyclone with circular isobars develops in the *pampas* of northern Argentina and moves to sea via the Río Plata with increasing intensity and strong southeast winds and gales, known locally as *suestedas*, or southeasters, along the coast of Uruguay. Otherwise, no low-pressure centers pass over the mainland of South America, most of the rain occurring as precipitation due to convection or cold-front passages.

The cold waves of Argentina cannot be compared with those which sweep the United States and Canada each winter. In South America, all polar air must come from the seas south of the continent, rather than from a vast snow-covered land area and the frozen polar seas as is the case in North America. The lowest temperature recorded outside the Andes in Argentina was only 7° below zero, while in Canadian North America the thermometer registers 78° F. below.

Terrific blizzards rage down to altitudes as low as 6,000 or 7,000 feet in the Chilean mountains.

Yet, in South America the cool waves may penetrate much farther from their source than in North America, since, when it is once on the continent, the polar air has to travel only over land areas in its journey into the low latitudes of the Amazon Basin. In fact, South American

Beautiful cloud effects are often seen in the clear air of the mountains.

polar air sometimes reaches the Equator in the Amazon Valley. On the other hand, cold waves coming south from North America are subject to such rapid modification after moving out over the warm waters of the Gulf of Mexico and the Caribbean Sea that no drop in temperature is noticed below 10° of latitude north of the Equator.

Summer conditions are much more comparable at corresponding latitudes in North and South America. In fact, the similarity is striking between much of Argentina and Chile and the United States. In both regions the west coasts are generally cool and dry in the summer, except in extreme southern Chile where the interior plains are hot and subject to some blowing dust, and the eastern lowlands are hot and damp.

The Rainfall Pattern in Equatorial Section

The two outstanding features of precipitation in northern South America are the torrential rains occurring at all seasons on the Pacific coast of Colombia and the droughts of northeastern Brazil. The Colombian west coast is an exceedingly rainy place, with an average of over 300 inches of rain falling in each year at some places. In that region rain can be expected five days out of six, and crops must be planned accordingly. In many years the interior of northeastern Brazil has adequate rain for growing crops, and the soil is reasonably good. But then, sometimes for 2 or 3 years in succession, the rains fail, and famine may be the result. There irrigation would seem to be the solution.

A knowledge of these features of weather is important to anyone who would successfully work for the development of the vast natural resources of South America. Only through such knowledge can man learn to work with the weather rather than find his agricultural enterprises balked by it. Intelligently considered, climate becomes a great natural resource.

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Cropping Practices in El Salvador

Every country has customs peculiar to its own agriculture. The sharp contrast between the rainy and dry seasons creates some interesting cropping practices in El Salvador.

by JAMES M. WATKINS

El Salvador is often thought of as a country of intensive farming. According to agricultural statistics of the Republic, however, the staple crops, including coffee, occupy approximately one-tenth of the total area, about an equal amount is devoted to pasture lands, and the remaining four-fifths is mostly unadapted to agriculture.

Coffee is the chief crop of the Republic and comprises by far the major proportion of the exports. In fact, the wealth of the country is almost entirely dependent upon this crop. In general, most of the best land at an elevation of 2,500 to 5,000 feet is used for its production. The major region of coffee production is near Santa Ana, the second-largest city of El Salvador, although good coffee is grown in several other areas also.

The second crop is corn. There are no limitations or boundaries to its production; it is found in high lands and low lands, on good soils and poor soils, and in the most out-of-the-way places. This is natural, since it is the chief food crop of the people. The tortilla is to the Salvadoran farmer what, in the United States, corn bread is to the native Southerner or potatoes and wheat bread are to the Yankee.

After excluding these two crops from the agricultural pattern of the country, certain groupings can be applied. Much of the coastal region, even the best soils, is used for pasture. Some corn, beans, and sugarcane are grown in this area but they are concentrated mostly in the upland valleys, such as the San Andrés and the Jiboa Valleys. Some highland rice is produced here also, but for the most part rice is produced in the hill country towards La Libertad and Sonsonate. In the lowlands of San Miguel considerable territory is given over almost entirely to the production of cotton and henequen. The remaining scattered areas, mostly poor upland or hilly soils, produce sugarcane, sorghum, corn, and beans. The production of garden vegetables is scattered about in the highlands, usually on a small scale but in sufficient quantities to support the populace of the country. There is little land which has not been cleared of the forest at some time for the growing of crops, but vast areas, such as the thornbush near San Miguel, have been abandoned because of poor drainage, heavy soils, or some other reason.

The Jiboa Valley of El Salvador from the Pan American Highway. Sugarcane is raised in the Valley and coffee grows on the highlands of San Vincente Volcano.

Planting Practices

The date of planting for most crops is usually determined by the moon. The common theory is that seed sowing must be completed within a certain time after the new moon. For beans the time is 3 days *adelante luna tierna,* that is, after the new moon, but corn and in general most crops are seeded 8 days *adelante.* In harvesting a crop the same theory is followed. Corn, beans, or rice harvested before the 8-day *adelante* are expected to be eaten by insects. The same applies to the cutting of wood. The author has had many arguments with good friends in El Salvador over this theory, just as he has in the United States, where the moon theory also partly prevails in some rural areas. Many of the progressive men of the country, however, are aware that these are probably superstitions and are deeply interested in placing the agriculture of the country on a more scientific basis.

Each year a month or so just previous to the rainy season most of the Salvadoran farmers clear off the area to be used and burn all the plant material and rubbish. The atmosphere becomes hazy with smoke and stays this way until the rains begin. The reasons offered for this practice are that it kills insects and weeds, makes available the minerals in the plant material, and facilitates cultivation. The ordinary grower has not learned the advantages of leaving the organic material to improve the soil texture, improve the moisture-holding capacity, increase bacterial action, help prevent erosion, and in general to work for the betterment of the soil. Until some procedure has been devised, where machinery is not available, for using the material and incorporating it into the soil, this practice may continue to be followed.

In most of El Salvador the farmer must condition his plans to the 6 months of rainy season, from May to October, when it is possible to grow crops. The rest of the year is without rainfall and the soils become exceedingly dry. This means that he must make his plantings from May to August or September in order that the plants may have moisture during their growth. There are three periods favorable for planting crops. The main period, and probably the most important, is the early seeding in May when the rains begin. The second is in August and September. Seedings in July are not usually satisfactory because of the heavy rains and perhaps for other reasons. During October and November, the third period, seedings are possible only in the few areas which can be irrigated or which are humid in the dry season from seepage waters that provide sufficient moisture for plant growth.

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Corn Practices Representative

Corn, which is the typical and most commonly cultivated crop, is seeded for the best results in May. The farmer has learned through experience that corn should be planted early in the season with the first rains. This practice has several advantages. It gives the plants a start before the weeds obtain a foothold. There seems to be less injury from insects at this time, and the plants apparently receive more sunlight before the advent of the heavily clouded days which will come later in the rainy period. As the individual farmer has only a machete and a wooden plow, he must use all precautions and resources to enable him to keep ahead of the enemies of his crop.

Plowing is done with a wooden plow, the nature of which makes it almost impossible to cover much area in the time available to the small farmer. One or two *manzanas* — a *manzana* equals approximately 1.73 acres —are about all that he can manage successfully. As soon as the land is prepared, he seeds the corn by hand and covers it with his foot. Seedings are usually made in rows 24 to 36 inches wide. Within the row the hills are spaced from 18 to 30 inches apart, and often there will be as many as 7 plants to the hill, although the usual number is about 4. Because of this large number of plants per hill, the plants never grow very large, except in those few areas where the fertility is extremely high.

This early May planting of corn is almost entirely to produce grain and is called *milpa.* Sometimes the farmer waits until the August planting period, especially if the corn is to be used for forage. This second-period planting is called *tunamil.* In sections where the soil is moist during the first part of the dry season and the corn is to be used entirely for forage during the dry period the seeding may be made in the later period, in November. It is seeded thickly like a grass and is called *guate.*

Almost all cultivation is done with a large curved knife

Corn is grown on steep hillsides.

The *cuma* is much used in the cultivation of crops in El Salvador.

called the *cuma*. The corn is kept free of weeds until July, but after that time weed control becomes extremely difficult. Before the corn is completely matured, the plant is broken over just below the ear on the stalk. This allows the rain to drain away from the ear so that it does not rot in the field, and the corn can be left standing until October or November, when the dry season begins. Then it is harvested.

In August and September the corn field is given a good cleaning, and beans, sorghum, or grasses may be sown in between the rows without further preparation. The trash on the surface of the ground serves as a mulch and helps to keep down the weeds and also to conserve moisture. Ordinarily a long stick with a knife on the end, called a *chusó*, is used in making these seedings.

Hill farming is probably the most common of all forms of cultivation. In almost any region of the highlands, hillsides can be seen cleared for a crop like corn, beans, or sorghum. While this practice may be good in that it allows for good drainage during the rainy season and may produce fairly good crops at first, it is a disastrous practice because it so often results in severe erosion. Unless conservation measures to prevent erosion can be established or land converted to crops to which they are best adapted, this hill farming is likely to continue until the soils are so completely depleted that they have to be abandoned. Almost the only places where conservation measures have been inaugurated so far are the coffee fincas. Here *isote* (*Yucca elephantipes*), which is called yucca or Spanish needle in English, is utilized on the contour to prevent erosion and has proved highly effective in some cases.

Rotation Systems

A few Salvadoran farmers, especially in regions like San Andrés and in and around the Jiboa Valley, are realizing somewhat the dangers of continuous cropping of land with one crop and the value of crop rotation. Many farmers without that scientific knowledge are learning by experience that beans or rice planted on corn land mean better crops of corn. A knowledge of rotation systems is probably one of the greatest needs.

Beans planted in August in with corn may add nutrition to the soil, even though the plant is usually pulled and the vines burned after the beans are harvested. The vines are often so dry at the time of harvest that few leaves remain. Nevertheless, if the plant material were returned to the soil after harvest it would furnish a certain amount of needed organic matter.

Another system that is being used to good advantage is to follow corn that has had beans seeded in with it one year by sugarcane or rice the next year. For instance, cane is planted in November after the corn and beans are harvested, and it is then ready for harvesting the following November or on into January. In the rainy season the cane affords a good cover on the soil so that weeds are not too prevalent. The life cycle of an insect may be broken by the change and a great deal of insect damage avoided. True enough these are not complete rotations, but they are an advance in the right direction and with some further thoughtful changes they could be made even more satisfactory.

In scattered regions of poorer soils and in the extreme highlands, particularly in the northern region that is close to Honduras, another system is used, that of allowing land which has been used for corn with beans or sorghum, or for vegetables alone, during one year to grow up to pasture or to scrub growth the following year. The length of time that it is left to pasture or scrub growth depends upon the value of the land, upon the need for land, and the availability of other areas for clearing. In some mountain sections the land has been so severely cropped and consequently eroded that they have been completely abandoned. The practice of leaving scrub or forest growth not only allows the soil to accumulate organic matter and build up to a better condition during the rest period, but it also furnishes badly needed wood.

Future Planning

One of the greatest agricultural needs in El Salvador is land-use planning. Some steep areas might better be left in forests. More efficient use of the lowlands could be made to balance this loss of cultivated land. Where changing the picture entirely is not feasible, more satisfactory methods of farming the hillsides should be adopted, with measures for erosion control. A good system of crop rotation could be worked out so that green manure would be supplied and the use of more varied crops result in benefit to each crop by its place in the rotation. This forward-looking program would bring about a better agriculture for El Salvador.

ALONG THE *Agricultural Front*

▲ New Methods Described for Storing Dried Eggs

Some interesting experiments have been made recently on the best methods of storing dried eggs. The most important factor in saving the flavor and cooking quality seems to be the temperature at which the dried eggs are kept.

By laboratory experiment, food research specialists have found that scrambled eggs, baked custards, popovers, mayonnaise, and foundation cake made with good-quality spray-dried whole eggs that had been stored for a year at temperatures below 60° F. were no different from those made with fresh shell eggs. On the other hand, scrambled eggs made from dried eggs stored for less than 1 month at 86° F. and above were dry, grainy, and brownish, and custards were soft and watery.

The quality of dried eggs kept under unfavorable storage conditions, such as the high temperatures encountered in many war theaters, drops rapidly. With proper storage methods, however, dried eggs may prove a useful supplement to shell eggs and offer the advantage of compact storage and of helping to equalize prices during the year by preserving the spring surplus for the winter months.

▲ Texas 4-H Club Boys Visit Mexico

Twenty-four 4-H Club boys from Texas recently paid a neighborly visit to Mexico. The boys were chosen for the trip because of their achievements in community leadership, war work, and production, as well as character and personality.

The boys traveled to Mexico by automobile and had an excellent opportunity to see how agriculture is carried on south of the border. They were accompanied on the trip by Texas 4-H Boys' Club leader, L. L. Johnson, and Dr. E. H. Shinn, field agent, 4-H work for the Southern States.

The average age of the boys was 17 years and the average of their experience in club work was 5½ years. On May 31, at a banquet in Mexico City, the boys entertained 24 Mexican boys of corresponding age and agricultural experience.

▲ Panama Shows Increased Demand for Insecticides

The use of insecticides and fungicides in Panama is increasing rapidly, largely through the extensive program of agricultural development being carried on by the Government of Panama. The Institute of Inter-American Affairs has aided in establishing a program of distribution of insecticides and fungicides which is to be carried on by the *Banco Agro-Pecuario e Industrial,* a government institution for promoting and assisting the development of agriculture in the interior of the Republic.

Under the program, more than 46,000 pounds of insecticides and fungicides were consumed in Panama during 1944. This estimate does not include the amounts used by the United Fruit and the Chiriquí Land Companies. The leaf-cutting ant is one of the most serious pests in Panama, and large amounts of white arsenic have been used to combat it. Approximately 1,000 gallons of tick dip were used by the cattle industry during 1944. The Agricultural Section of the Ministry of Agriculture and Commerce has installed 13 insect-control bathing stations for cattle in the agricultural provinces. Dipping vats are being built throughout the Republic, and service will be rendered free of charge and will be obligatory for farmers located within the vicinity of the stations. Larger cattle owners are constructing their own dipping vats.

The prevalence of insects in the Tropics and the need for control of malaria make necessary the wide use of household insecticides and disinfectants. In 1944 something like $18,000 worth of household insecticides were used.

RIO COLORADO

(Continued from back cover)

the regions farther south. The average annual rainfall is about 2 or 3 inches a year. The climate, with its long growing season and abundance of sunlight, is ideal for grapes and apricots, the area being devoted almost exclusively to grape production, both wine and table varieties.

Mendoza Oasis has an average rainfall of about 10 inches and an average temperature of between 50° and 60° F. This oasis is rated as the vineyard of Argentina, and the city of Mendoza, with its more than 80,000 inhabitants, is the center of the nation's wine industry.

San Rafael, to the south, is separated from the Mendoza Oasis by desert. Its climate is well adapted to tree fruits and it has become the most important apple and pear district. The soil is chiefly of volcanic origin, rich and fertile.

The irrigated districts of Tunuyán, Tupungato, and San Martín are less-important producers of fruit. Tunuyán and Tupungato, however, are noted for the high color and fine flavor of their fruit. They are located on the fringe of the Andes and specialize largely in apple and pear production. San Martín is better adapted to stone fruits.

The provinces of San Juan and Mendoza, in which the three important oases are located, is known as the Cuyo region. This region, embracing approximately 250,000 acres, includes about 75 percent of Argentina's vineyard acreage. Production of wine grapes in 1943-44 was about 980,000 short tons, or 85 percent of the total for the country. Wine production is among the leading industries of Argentina. Argentina ranks fifth among the wine-producing countries of the world, having an average output of about 130 to 150 million gallons, the Cuyo region supplying 95 percent of that amount.

Alfalfa occupies more land in the oases than do grapes, and its production is carried on as a means of livelihood distinctly separate from fruit farming. The crop is especially useful for fattening beef cattle for the region and furnishing seed for alfalfa ranges in eastern Argentina. Land is also devoted to corn and vegetable raising. Recently an olive development has been started here, but no exportable surplus is expected soon, as several

years are required for the trees to bear fruit.

Petroleum, a much-needed source of fuel supply for Argentina, is obtained from the Mendoza oil fields at Tupungato. Mendoza Province ranked second as a petroleum supplier in Argentina in 1941, producing more than 3,300,000 barrels.

Patagonian Region

The saline steppes between the Andes and the Pampa gradually rise in elevation towards the south and, in the neighborhood of the main stream of the Río Colorado, merge into the plateaus of Patagonia. These plateaus are cool, dry, and windswept, and are covered with a desert shrub except in irrigated regions along the river bottoms. Here the Colorado River Valley is some 100 to 300 feet below the plateaus, where it is protected from the high winds. Irrigation is used to produce crops in the valley and some commercial farming is carried on. Sheep raising, chiefly for wool, is still the principal industry of the Patagonian region, although cattle raising is carried on to some extent. The average rainfall is about 10 inches, and the population, which averages less than two people per square mile, consists largely of English, Scotch, and Welsh herdsmen.

Southern Pampa

The Río Colorado touches only the southern part of the Pampa, where the land is better for grain than for grazing. Oats do well along the coast. A sheep-grazing area has developed, however, using oat and rye pastures. The poor pastures in this region are due to shallow soils as well as to relatively long periods of frost and low temperatures. It is known as a short-pasture-grass area, and, although sheep thrive here, it is one of the least important cattle areas of the Pampa.

Much of the Colorado River Basin is a vast dry, relatively unproductive region, but the spots of irrigated land which dot this expansive landscape produce commodities of great value to the entire country and are vital to the production of the basin area. The commercially important centers of vineyards and tree fruits developed on these oases have been instrumental in Argentina's rise to a place of international importance as a fruit-producing nation.

TINGO MARIA

(Continued from page 165)

Location

The main station of Tingo María is on the Pucallpa Highway, about 260 miles northeast of Lima, 2,300 feet above sea level. A number of sub-stations also have been established in eastern Peru.

That part of the eastern slope of the Andes on which the main station and several of the sub-stations are located is a rich and diversified agricultural region with an ideal climate. Below it stretch hundreds of miles of tropical rain forest typical of the upper Amazon Valley. Not all of the soils of the region are potentially productive, but great areas can vie with any equatorial region of the world in the natural conditions for crop growth.

Research Projects

No time was lost in beginning research projects after the Memorandum of Understanding was approved by both countries, in 1942.

In that same year, the Station took over the Hevea rubber nursery which had been started by the Peruvian Government. Plant reproduction has been so successful that the future of the program as a whole seems assured. Demonstration Hevea plantations have been established and are being cultivated by methods formulated as the result of research so far and utilizing planting material developed at Tingo María.

Cinchona (source of quinine) culture was started at a sub-station, known as *Fundo Sinchono,* about 30 miles from Tingo María on the highway to Pucallpa. As a result of work done there, the high-quality cinchona plant, whose value as a malaria-combatting medicine was first known long ago in Peru, has returned to its native country. Problems relating to its systematic cultivation and the technical aspects of its commercial production are receiving careful study.

Derris cuttings were sent from the U. S. Department of Agriculture's experiment station in Mayagüez, Puerto Rico, to stimulate rotenone research. Tingo María scientists are likewise examining the great variety of other rotenone-producing plants known by the collective name of barbasco, to meet the great demand in world markets for insecticides.

Research work in connection with tea production is being carried on, and investigations are in progress to discover the most suitable locations for growth of the plant and to perfect the most modern and practicable methods for its cultivation. Attention has been given also to other such commodities as manila fiber (abacá) and cacao.

Experiments have progressed in connection with soil surveys, soil management, land use, botanical studies, and forest and nursery projects for selected species of trees. An extension program is being developed with farmers based on analyses of the population and social organization of the various communities.

Value of Program

The benefits to participating countries through the cooperative complementary products program are great. They cannot be measured on a dollars-and-cents basis. Neither are they limited to these countries alone, for the whole world may share in the benefits. Agriculture is, in truth, a firm and natural basis for international unity and understanding.

Food for the World, edited by Theodore W. Schultz. 353 pp., tables and charts. University of Chicago Press, Chicago, Illinois, 1945. Twenty-three experts in economics, nutrition, population, and agriculture have united in an attempt to answer, in this book of essays, such international food questions as: Will the demand for food stay abreast of agricultural production in a country like the United States? Can countries like Russia, with its rapidly growing population and rising standard of living, or India and China, with their high potential growth of population, increase food supplies enough to improve the diets of the people? What kind of trade arrangements can be made to supply the needed food? How can people be educated to choose diets that are nutritionally adequate?

Economic Problems of Latin America, edited by Seymour E. Harris. 465 pp., tables, charts, maps. McGraw-Hill Book Company, Inc., New York, N. Y., 1944. Each of seventeen economists has written a chapter for this book, in the particular field or area of his study. The book is divided into three parts. Part I consists of an introduction, treating of several general economic issues of outstanding importance and common to all countries of Latin America. Part II covers important special aspects of Latin American economics, including among its titles "War and Postwar Agricultural Problems of Latin America," "Exchanges and Prices," "Inter-American Trade Policy." Part III contains studies of Argentina, Bolivia, Brazil, Chile, Colombia, Cuba, Haiti, Mexico, Paraguay, and Venezuela.

Agricultura chilena de post-guerra. 73 pp., tables. Instituto de Economía Agrícola, Santiago, Chile, 1944. A report of the Commission on Postwar Agriculture in Chile. The report contains sections on such subjects as: Probable tendencies of the postwar economic world, Chile's national economy, present national agriculture, adapted agriculture, education of the rural worker and the city consumer, and labor. An appendix contains tables of production of various products.

El Futuro de la Lana (The Future of Wool), by Pablo Link. 71 pp., charts and tables. Imprenta Ferrari Hermanos, Bartolomé Mitre 3355-65, Buenos Aires, 1944. This is a survey of the present state of wool production in Argentina and a discussion of the future of wool in postwar days. It is based on the data in *Agricultural Statistics up to the 30th of September 1942,* a pamphlet published by the Department of Rural Economy and Statistics of the Ministry of Agriculture. A translation in English is included.

EDITOR'S NOTE.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

AGRICULTURE IN THE AMERICAS — O. R. CARRINGTON, EDITOR

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Gifts of the Americas

PEPPERS

by JEWELLE OERTEL

Columbus sailed the western seas in search of pepper and other precious spices. He found peppers, but not the Eastern black and white peppers of the *Piper nigrum* which he was hunting.

To American horticulturists peppers generally mean the red-fruited bell pepper, *Capsicum grossum,* of which the green pepper is merely the unripe stage. The name *Capsicum* is of uncertain origin, perhaps from *kapto,* to bite, on account of the peppery pungency, or from *capsa,* a chest, having reference to the form of the fruit. In Mexico the name for the hottest peppers is *chili,* the Aztec name for *C. annuum.* The Incan name was *ají.*

How primitive man discovered that the fruits of a plant apparently belonging to a poisonous group, the nightshades, were edible is a mystery. The Indians did make the discovery, however, and they cultivated and improved the pepper plants until the tiny hot berries had been developed into a number of varieties. No one knows just how many varieties the early Indians grew. But we know from fruit and vegetable designs on their pottery vessels that they cultivated many of the present-day varieties.

Probably no other cultivated food plant comes in so many forms. There are peppers of every imaginable shape, size, and degree of pungency. Some are round, conical, flat like beans, or in the shape of carrots or pears. They may be dark red, scarlet, yellow, or almost white. In size they vary from big ones shaped like bullnoses to tiny berries about the size of a pea. There is one variety with delicate leaves and cherry-like fruit grown as an ornamental plant. The small, pale-yellow, "innocent-looking bird peppers" are the most fiery; the bullnoses are the mildest.

To become a pepper eater requires practice. An Oriental coolie will grind up entire fruits of the bird or devil pepper and eat this fiery paste mixed in his rice and beans in amounts that would paralyze or injure the throat and mouth nerves of anyone not accustomed to it. Some of these spice plants are dangerous to handle, so exceedingly caustic is the oleoresin in their fruits and seeds.

Among the hottest are the Mexican devil peppers. Tabasco sauce made from them has become world famous. But the strongest Tabasco sauce cannot equal some West Indian pepper sauces.

Pepper was known to Hippocrates for its medicinal properties. In early times it was thought to be beneficial for such ailments as dropsy, colic, ague, and toothache, and, mixed with honey and applied externally, as a remedy for quinsy. Preparations were given internally as a gastric stimulant. It has also been used externally as a liniment, and as a gargle for sore throat.

Chauca, physician to Columbus, in 1494 first mentioned the New World pepper as a condiment. Writers about a century later mentioned its use in dressing meats and in dyeing. The Spanish writer Monardes (1577) says: "Pepper from America, tall bush, some pepper be long, others rounde, others of the making of Mellons, others of cherries but all bee at the beginning when they be not ripe verie green and when ripe verie redde."

In their modern use as a condiment and vegetable, peppers are pleasing and are believed to be harmless unless used in excess. Cayenne pepper is prepared by grinding the dried fruits, seeds and all, of *Capsicum frutescens* or *C. annuum.* Mild Hungarian paprika is made from the dried and ground fruits from which the seeds and membranes have been removed. Mexicans often eat the hot varieties raw. These varieties also form an important ingredient of tamales, which have crossed the border into the United States. Pimentos are used as a relish or flavor, as in stuffed olives and pimento cheese. The large, thick-fleshed, sweet varieties are more desired by persons farther north, who serve them like tomatoes either ripe or green, with vinegar and salt, or filled with chowchow pickles. They may be fried, minced, and mixed with raw salads, or stuffed with meat and baked. Green peppers are a very good source of Vitamin C; as they ripen, they increase in carotene content and become rich in Vitamin A.

Capsicums are American. Long centuries before Columbus landed on the shores of the New World, peppers had spread from the land of the Incas to Central America and Mexico. Although he did not find the pepper he was seeking, he did find peppers which are truly a gift of the Americas to the world.

RIO COLORADO BASIN—ARGENTINA

by **Constance H. Farnworth**

The Río Colorado system of central Argentina flows through a large part of the country's important vineyard and fruit area. The source of the river is in the eastern part of the Andes, where it is fed by intermittent streams formed by the melting snows of the mountains at altitudes up to 17,000 feet.

The two tributaries of note directly entering the Colorado are the Río Grande and Río Curacó, which is the name of the river formed by the union of the Salado and Atuel. Some of the smaller tributaries tumble down the side of the barren Andes onto broad fan-shaped alluvial plains to pursue a southeast course across a desert area, mostly without exterior drainage and similar to the Great Basin of the United States. Here the streams unite their waters in a zone of sloughs or playas. Some of the water makes its way through these playas during high water to enter the Río Salado, which extends 975 miles. Most of the time water escapes from the playas only by evaporation.

The main stream of the Río Colorado continues across the northern part of the Patagonian Plateau eastward to southern La Pampa, where it is joined by the Salado-Curacó and later discharges through the several channels of its delta into the Atlantic Ocean. Transportation from most of the basin is difficult, with the river itself navigable for only 200 miles.

The Oases

The streams rising in the Andes carry a heavy load of sediment which is deposited where they reach the desert plains, forming rich alluvial fans. When irrigated with water from the streams, these alluvial fans stand out as green oases in the surrounding desert. Their water supply, however, is not stable, as the amount available depends upon the snow pack which feeds the streams. Diversion dams have been built, but sufficient water is not stored to assure supplies for the growing season. Also, the oases are in the path of severe hailstorms which often damage the crops. Aside from these factors the oases are adaptable to the types of specialized irrigation agriculture practiced on them.

Because of the great aridity of this general area, most of the people not directly dependent upon the production of the oases are engaged in the grazing industry, which is limited by the meager pastures of shrubs and hard grasses to the raising of goats, low-grade cattle, and sheep for wool. The land used for grazing is sparsely populated, but the oases have a relatively dense population and high agricultural productivity. Many of the people are of Italian and Spanish stock.

In addition to numerous small oases, the three most important ones are the San Juan, Mendoza, and San Rafael. The Río San Juan supports the San Juan Oasis. About 100 miles to the south the Mendoza Oasis has water furnished by the Río Mendoza and the Río Tunuyán, and still farther south the San Rafael Oasis is supported by the Diamante and Atuel rivers.

In the region of the San Juan Oasis the climate is hotter and drier than in

(Continued on page 176)

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Agriculture in the Americas

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NAMES & NEWS

Samuel Work Goes to Guatemala

Samuel H. Work, Animal Husbandman, Office of Foreign Agricultural Relations, has been temporarily assigned to the Cooperative Agricultural Experiment Station in Guatemala, where he will work on problems relative to the animal industry of that country.

●

To Visit Experiment Stations

Ralph H. Allee, Assistant Chief, and *Horace V. Geib,* Head, Station Management Division, of the Technical Collaboration Branch, Office of Foreign Agricultural Relations, left recently for Colombia, Nicaragua, El Salvador, Guatemala, Panama, and the Canal Zone. The two men will visit a number of cooperative agricultural experiment stations and study the possibilities of establishing a similar station in Colombia.

●

Wellman Returns to El Salvador

Frederick L. Wellman, Senior Pathologist, Office of Foreign Agricultural Relations, who came to Washington to confer with officials, has returned to the Cooperative Agricultural Experiment Station in El Salvador, where he is in charge of all pathological and disease-control activities. Dr. Wellman is giving particular attention to rubber, fibers, medicinal plants, vegetable oils, and insecticides.

●

Receives Professorship at University of Medellín

Walter H. Hodge, Professor of Plant Geography and Economic Botany, Massachusetts State College, who has been carrying on work with cinchona in Peru for the Foreign Economic Administration, has accepted a one-year visiting professorship at the University of Medellín, in Colombia.

Dr. Swingle in Peru

Charles F. Swingle, Horticulturist, Office of Foreign Agricultural Relations, left Washington recently for Tingo María, Peru, where he will serve as horticulturist at the Cooperative Agricultural Experiment Station. Dr. Swingle will remain in Peru indefinitely.

●

Moncure Returns to Washington

Robert C. Moncure, Agriculturist, Office of Foreign Agricultural Relations, has returned to Washington after visiting Guatemala, El Salvador, Nicaragua, and Costa Rica. During his trip Mr. Moncure conferred with officials of the various Agricultural Experiment Stations. He also visited the Bureau of Plant Industry Rubber Station, and the Institute of Inter-American Agricultural Sciences, at Turrialba.

●

Public Health Official Visits United States

Dr. Julio Roberto Herrera, Director General of Public Health, Republic of Guatemala, is in the United States visiting regional and national public health offices. His itinerary includes the District of Columbia, New York, Maryland, Pennsylvania, and New England. Dr. Herrera, who once held a Rockefeller Foundation Fellowship at Johns Hopkins University, has been in Public Health Service work in his country for the last 14 years. He is particularly interested in parasitology and malariology.

●

A. Rex Johnson Visits Latin American Republics

A. Rex Johnson, Assistant Director, Office of Foreign Agricultural Relations, returned to the United States recently from an extended visit to Cuba, Haiti, Dominican Republic, Trinidad, Brazil, Argentina, Chile, Peru, Ecuador, Guatemala, and Mexico. Dr. Johnson reviewed the problems of agricultural reporting at the U. S. Embassies, inspected the work of the various Cooperative Agricultural Experiment Stations, and conferred with officials on problems relative to agricultural cooperation between this country and the other American republics.

Agriculture IN THE Americas

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Third Inter-American Conference Stresses Postwar Problems

As the greatest war in history drew to its close, the Conference at Caracas strongly emphasized the solution of postwar agricultural and economic problems and the improvement of living standards in the Western Hemisphere.

by **JOHN J. HAGGERTY**

Caracas, the beautiful capital of Venezuela, was host city to the Third Inter-American Conference on Agriculture from July 23 to August 7. More than 200 delegates from the 21 American republics attended the Conference, which convened on the one hundred sixty-second anniversary of the birth of the great liberator, Simón Bolívar. Six international organizations were represented: Pan American Union, Inter-American Council of Commerce and Production, International Labor Office, United Nations Interim Commission on Food and Agriculture, United Nations Relief and Rehabilitation Administration, and Inter-American Statistical Institute.

The Chairman of the United States delegation was John B. Hutson, Under Secretary of Agriculture. The Vice Chairman was Leslie A. Wheeler, Director of the Office of Foreign Agricultural Relations. Eight other delegates and

The meetings of the Third Inter-American Conference on Agriculture were held in a fine new school building, named in honor of Andrés Bello, distinguished Venezuelan educator.

fifteen technical advisers in the United States delegation provided an able panel of experts on the various subjects covered in the agenda.

Two outstanding characteristics marked the Conference, setting it apart from the two preceding conferences, one held at Washington in 1930, the other at Mexico City in 1942. The first characteristic was its stronger emphasis on questions of inter-American economic policy. The second was the clear recognition of mutuality of interests in solving the problems to be faced in the postwar period.

This harmonious outlook had already been substantially molded in the United Nations Conferences at Hot Springs, at Bretton Woods, and at San Francisco, and in the Inter-American Conference on Problems of War and Peace in Chapultepec Castle at Mexico City in February of this year. The delegations recognized that the solution of compelling issues and adjustment problems of the postwar period will require united and unselfish efforts on the part of all American nations, working in close harmony.

Organization of the Conference

In accordance with the agenda and the rules of procedure adopted in the preliminary session on July 23, six technical commissions and 20 sub-commissions were organized, dealing with: Money and Agriculture, Present Agricultural Production and its Adjustments to the Postwar Period, Foodstuffs and Raw Materials, Markets and Transportation, Agricultural Migration in the Postwar Years, and Agricultural Statistics. In addition, a Commission on Resolutions was established, composed of the chairmen of all delegations, and a Committee on Style to edit the resolutions, composed of delegates from Ecuador, Argentina, and Costa Rica. In view of Mr. Hutson's previously announced intention to leave the Conference before its adjournment because of pressing matters in Washington, Mr. Wheeler represented the United States on the Commission on Resolutions, of which he was elected the *rapporteur*.

Members of the United States delegation at the Washington National Airport just before departure for Caracas.

Resolutions and Studies Introduced

After establishment of the six technical commissions, primary consideration was given to the 177 resolutions and 48 studies presented by various country delegations through the central secretariat. Because of the large number of resolutions, the fact that many resolutions pertained to the same subject, and the wide range of views of the different delegates, the process of combining and redrafting the resolutions was a difficult one.

Finally adopted by the Conference were 46 resolutions relating to increased efficiency of agriculture and improved nutrition, 10 on international trade, 10 on marketing and distribution, 10 on migration and colonization, 10 on agricultural statistics, 6 in the realm of finance and credit, and 6 of a general character.

Many of these resolutions bring out the need for greater application of science to agriculture, intensified agricultural education and extension, improved human nutrition, better marketing facilities, and agricultural statistics. Several reaffirm the importance of intensifying programs of inter-American technical collaboration in order to increase efficiency and expand the volume of agricultural production, and to improve the income and levels of living of farm people.

Certain of them stand out because of their greater implications to future regional or world developments.

International Organizations for Food and Agriculture

Since the inception of the World Organization on Food and Agriculture (FAO) at Hot Springs in 1943, serious thought has been given to the future role of regional institutions, such as the Inter-American Conference on Agriculture, in relation to the contemplated world organization. Resolution IV recognizes the preeminent place of the FAO in world planning for food and agriculture and that the food and agricultural programs of the American nations are of world-wide concern.

The Conference recommended that the Pan American Union establish liaison with FAO to assure participation by the Pan American Union in the meetings of that organization. It also recommended that the Executive Committee of the Inter-American Conference on Agriculture explore with the Pan American Union the best methods of conducting future conferences to assure integration of the efforts of all international agencies dealing with food and agriculture, to the end that all peoples of the world might enjoy the highest attainable standard of living.

Money and Credit

Both previous Inter-American Conferences on Agriculture adopted resolutions urging the establishment of an inter-American credit institution of some kind which would meet the credit needs of an expanding agriculture. The

Caracas, birthplace of the great liberator, Simón Bolívar, is one o f South America's most beautiful and historical cities.

Bretton Woods agreements extended this idea while at the same time interrupting legislative processes looking to the establishment of the Inter-American Bank as earlier proposed.

Two resolutions adopted at Caracas now tend to clarify the Bretton Woods agreements in relation to the Western Hemisphere. Resolution VII on Monetary Stabilization and Exchange Rates endorses the Bretton Woods plan but urges caution in the administration of the monetary fund in order to avoid unnecessary dislocations in the economies of nations which may have established preferential rates of exchange to facilitate war-emergency or basic agricultural production. The resolution further recommends that the American nations, as a means of avoiding basic inequalities in payment balances, cooperate to assure favorable prices and markets for their agricultural products.

The author is in charge of the Central and South American sections of the Western Hemisphere Division, Regional Investigations Branch, Office of Foreign Agricultural Relations.

Resolution X specifically recommends that the realization of the regional aims for an inter-American agricultural credit institution be entrusted to the World Bank for Reconstruction and Development, in which it is recommended there be established a special department for the extension of agricultural credit to the American countries. The American nations are also called upon to create the necessary national legal instruments to implement the operations of the contemplated World Bank.

Production, Consumption, and Trade Policies

A group of resolutions, some of which reflect concern for the regional needs of the Western Hemisphere, as contrasted with a world viewpoint, deal with studies and economic policy in the realm of agricultural production planning for the early postwar period. Numbers XIII and XXII specifically refer to the so-called special or industrial crops (such as rubber, hard fibers, medicinal plants, insecticides, vegetable oils, and others) and recommend that American economic policy feature their development; that the Pan American Union organize special commodity

studies and make appropriate recommendations to member governments concerning these crops; that the Fourth Inter-American Conference on Agriculture (to be held not later than July 1948) give a prominent place in its agenda to a study of the progress of these crops in America; and that special commissions be established in Washington to study problems related to their production and consumption. Especially in the cases of rubber and the hard fibers, the commissions are to be organized as soon as possible to begin studies of the problems arising from competition, not only with the natural products obtained from other world regions, but also with similar synthetic products, the production of which has been stimulated by urgent war needs.

Resolution XVII states certain basic principles which should govern collective readjustment of agricultural production and trade to postwar conditions. It recognizes, first, that expansion of production and consumption provides the only durable solution, and that efficiency of production, based upon natural advantages, must be a cardinal principle in adjustment programs. The application of the principle of relative efficiency must, however, be moderated to recognize the traditional production patterns of the countries and the fact that the necessities of war have induced inefficient production in some instances. It also recognizes that adjustments must be orderly and gradual if national economies are not to be unjustly and unduly disturbed. These adjustments should take account of the needs of consumer nations.

Resolutions XVIII and LX recommend the encouragement of technical organizations and special instruction in primary and secondary schools to promote greater diversification of agriculture, husbanding of resources, and expansion of the smaller farm enterprises.

Photo by Luis Nogueras.

Delegates from 21 American republics assembled for the opening session.

International Commodity Agreements

Of special significance, in Resolution XVI the Conference recognized that economic policies looking to the expansion of agricultural production (as outlined in Resolution XVII) might result in temporary surpluses of some individual commodities, and that international commodity agreements may constitute an appropriate means for solving these problems of surpluses.

Certain basic principles were recommended to serve as a basis for these agreements. These principles are: The agreements should cover individual commodities; they should include producer and consumer nations according to their respective interests; and they should provide for efficiency in production and cooperation among nations in necessary adjustments, equitable division of the world market, reasonable price protection, and measures to expand consumption. No agreements involving limitation of production or export should go into effect until the basic causes of the problem have been investigated and the conclusion has been established that a burdensome surplus of the commodity, which cannot be corrected through the operation of normal market forces, exists or is threatened. A necessary counterpart of such an agreement is a program of adjustment to assure substantial progress toward solution of the problem during the life of the agreement. The recommendation is further made that the duration of all such agreements be carefully limited and that they be coordinated in accordance with the recommendations of an international agency charged with the study of the operations of all such agreements.

Marketing and Transportation

In a group of ten resolutions (LXIX to LXXVIII inclusive), the Conference took up a number of related problems in the fields of transportation and marketing, both national and international. Resolution LXXI specifically recommends the establishment within each country of more adequate facilities for preservation, storage, packing, and handling of food and other agricultural products, the establishment of market-news services in those republics where they do not exist, and the creation of warehouse systems, under public or private capital, to include the extension of credit to producers and shippers with stored merchandise serving as collateral. The principles are reaffirmed that international trade in essential agricultural products should be based upon efficiency in production, that the Americas should develop sound commercial policies including the reduction of trade barriers and avoidance of "dumping," and that trade-expansion measures and development of agricultural industries should be oriented toward high levels of income and living for rural populations.

Companion resolutions recommend closer regulation of the seed trade, requirement of labels stating the kind and

(*Continued on page* 194)

Courtesy Soil Conservation Service

Two Brazilian trainees receive instruction on channel-type terracing from a Texas landowner.

"In-Service" Training Pays

Learning by doing—that is the principle of the Soil Conservation Service training program. Thirty-seven Latin Americans have taken the training. Already many of them are working in their home countries to establish erosion-control practices.

by WILLIAM X. HULL

Erosion by water and wind has been, and still is, doing tremendous damage to the agricultural lands of most of the countries of the Western Hemisphere. Such damage results in decreased supplies of local agricultural products, both vegetal and animal. Year after year erosion goes on, and, unless measures are taken to stop or control it, the agriculture and the resulting economy of the countries will continue to suffer, and at an ever-increasing rate.

The United States recognized this terrible loss of good soil several decades ago, but until a little more than 20 years ago took no definite action to retard it. In 1933 the Soil Erosion Service, which later became the Soil Conservation Service, was organized by the Congress and began the actual work of saving the soil of the United States. In the beginning there were few trained technicians to carry on the work of soil and water conservation. Many practices were tried and discarded, until through trial and error the present practices have proved their value. But

this trial-and-error period took several years before the present program was perfected. The present training program for Latin American *técnicos* was developed and is carried on by the U. S. Department of Agriculture to lessen for the countries of South and Central America this long, hard trial-and-error period.

During 1942 and 1943, twenty-five agricultural technicians from thirteen Latin American countries received training in the principles and techniques of soil and moisture conservation.* During 1944 and 1945, twelve additional technicians from nine countries studied the same program.

How It Works

A program of this kind entails on the part of SCS a considerable amount of supervision. There are several hundred work units, groups of technicians, usually from two to five in number, who have under their supervision an area of farm or ranch land varying from ten ranches and farms up to several hundred. But not all technical men are teachers. Many excellent technical men cannot easily impart their knowledge to others and especially to foreign *técnicos*. Therefore, the work units to which these foreign *técnicos* are detailed are picked with great care. Insofar as possible the work unit to which a *técnico* is detailed will be in a section where topography and agronomic conditions are somewhat similar to those in his own country. The unit also must have one or more members who are teachers as well as technicians. While it is true, unfortunately, that very few of the SCS technicians know Spanish or other foreign languages, the language differences soon smooth out, and in a short time all are working together in harmony.

Courtesy Soil Conservation Service

Trainees learn to handle modern farm machinery.

This training and study is obtained by actually working on farms and ranches in various parts of the United States and Puerto Rico with trained technicians. Each *técnico* becomes a member of the staff of some Soil Conservation work unit. He works as he learns. He becomes a soils and conservation surveyor, then an agronomist, an agricultural engineer, a forester, a biologist, and finally a farm planner.

During this period of training and study—it takes about 6 months or possibly 7—he learns something of educational and informational technique in order to sell the conservation needs and program to the farmer or rancher. He learns how to talk with and work with farmers and ranchers. All this leads up to the final goal of being able to make a farm or ranch plan with the operator and then to supervise the application to the land of the conservation measures and practices recommended and agreed on by the *técnico* and the farmer.

This type of work-study training continues in two or three other locations in the United States, where the *técnico* meets different topographic, agronomic, and climatic conditions. Technicians, in combination with farmers and ranchers, have developed 52 different practices for the control of erosion, the conservation of water, and better land use, all leading to a better economic condition for the farmer. This better economic condition invariably leads to a higher level of consumption.

After approximately one year's study and training, the *técnico* returns to his home country, there to assume duties with his government, at a university, or in private work. Of the class of 1942-43, all but one man is in one way or another carrying on the practices he learned while he was on an "in-service" fellowship with the Department of Agriculture.

Countries Receive Dividends

Any good investment pays dividends on the capital invested. The Department feels that this fellowship program, even after so short a time, is paying handsome dividends.

In Mexico, an active Department of Soil Conservation has been in operation since 1942. Two members of the class of 1942-43 are actively engaged in conservation work. Three others of this same class are doing research or forestry work indirectly connected with conservation by working for better land use. Two members of the class of 1944-45, having completed their training in the United States, are now with their own Department carrying on the work.

In Central America, progress has been slow, but in Costa Rica that country's representative, Luis Arturo Fernández, of the class of 1942-43, has been conducting classes and lectures in the University. In January of 1945, he organized a special Conference in Soil Conservation at the School of Agriculture of the University of Costa Rica in honor of Dr. H. H. Bennett, Chief of the U. S. Soil Conservation Service. Jorge León, of Costa Rica, of the class of 1944-45, has also lately returned to his country and will enter conservation work.

Marcos Orozco, of Guatemala, was a member of the class of 1944-45. During training he received word from his

* *See* "Collaborators in Soil Conservation," in *Agriculture in the Americas*, May 1944.

government that, upon returning, his work in the Agricultural College is to be enlarged and he will teach soil conservation both in the college and on the demonstration farms.

It is yet too early to say what the trainees from Colombia of the 1944-45 class, Guillermo Ramírez and Víctor M. Vega, will do upon their return home. They are still pursuing their training, but they have received definite instructions from the government regarding their future work in Colombia. In each case it embraces putting into practice on the land the things each has learned here.

Ecuador's investment has not yet resulted in Ecuador's benefit. That country had two men in the 1942-43 class, who are still in the United States. In the 1944-45 class, however, two men, Gagliardo Bryant and César Herrera, have just lately returned to Ecuador. Mr. Herrera has definite commitments from his government for conservation work on his return.

Peru had two men in the 1942-43 class and one man in the 1944-45 class. Mario A. Baracco of the first class has done some conservation work and Luis O. de Armero of the 1944-45 class has just lately returned. As yet no report has been received from him as to his activities.

Argentina is actively engaged in conservation work. Casiano V. Quevedo, 1942-43, is Chief of the Division of *Suelos y Agrotécnica* and is carrying on an operations program, small as yet, but growing rapidly. Arturo Somoza, 1942-43, is teaching soil conservation in the University of Buenos Aires.

Carlos A. Fynn, 1942-43, of the University of Montevideo in Uruguay, is teaching conservation and has developed good demonstration programs on farms in his country. He is using conservation and farming practices on the land as he learned to do in the United States.

In Paraguay, Alfredo G. Antonelli, 1942-43, is making a survey of his country and has succeeded in getting quite a few conservation practices started.

There were three men in the 1942-43 class from Brazil. Paulo P. de Melo, from Recife, has done a remarkable job in getting a rather large area in his State converted to conservation farming. Jador T. de Rezende is applying conservation practices on the experiment station in his State of Rio de Janeiro. Of Silvino A. Batista, no reports of activities have reached us since he returned to his home.

In Venezuela, José Rugeles, 1942-43, is Assistant Chief of the Department of Conservation and Production. This Department is now active in the Andean region. Sebastián Romero and Ricardo Jahn Adoué, both 1942-43, remained in the United States after the completion of their training, for a year's special study at Cornell. They are both now in Venezuela working in experiment stations on conservation studies and research.

Mr. Hull is Foreign Liaison Representative for the U. S. Soil Conservation Service.

Courtesy Soil Conservation Service

César Herrera, of Ecuador, learns the intricacies of laying out contour lines.

In Haiti, Anthony Lespes, 1942-43, has done a remarkable job in getting a conservation program started on the steep lands of his mountainous country. He now has both small farmers and rich plantation operators beginning to farm safely. The following excerpt from a letter written by an Agricultural Attaché, Port-au-Prince, Haiti, and dated May 9, 1945, tells of the work in progress there.

> I made a trip yesterday which from the technological point of view was very interesting. It was to Kenscoff, up in the mountains at about 5,500 feet and is the place where Anthony Lespes has done most of his work in soil conservation since he returned from his year's training in the States, where he was with SCS.
>
> It is the place in the mountains southeast of Port-au-Prince where much of this city's vegetable supply is grown. Also wealthy people from here have their summer homes there.
>
> The idea of soil conservation has taken firm root in these people's minds and Kenscoff is the first expression of it in deeds. Mr. Lespes spent much of his time up there last year, running terraces, advising with wealthy residents and small farmers. As a result, much of the mountainside is covered with rock terraces. We saw many terraces under construction—some by two or three individuals in places and in some cases whole gangs of men were working together.
>
> The land is so steep that we would consider it far too steep for cultivation. It will average 45 percent or more slope. The terraces are far from perfect, but the remarkable thing is that

(*Continued on page* 194)

Bamboo in Ecuador's Lowlands

In Ecuador, local bamboos are being studied and certain Oriental species introduced to meet definite needs. Bamboo is becoming more and more extensively used in both rural and city life.

by F. A. McCLURE

Bamboo, known as *guadua* in Ecuador, occupies in the local economy of that country a position the importance of which is not generally recognized outside the country itself. Especially in the lowlands, it is a material of primary importance in the building industry.

In the rural parts of this area which I have visited, more than 90 percent of the dwellings, fences, bridges, and other structures are built principally of bamboo. Even in the great city of Guayaquil most of the buildings contain a certain amount of *guadua* in their structure. In the arid coastal parts southwest of Guayaquil, where neither bamboo nor forest trees grow, *guadua* is brought in from the more humid areas, where it thrives. It is at once the cheapest and most easily transported building material available in the lowlands of Ecuador.

Bamboos in Ecuador's Lowlands

Guadua angustifolia (Humb. & Bonpl.) Kunth, a species widely distributed in Central and South America, is the only one of industrial or economic importance thus far found in the lowlands of Ecuador. It is a magnificent plant, with culms, or stems, often 6 inches in diameter and more than 80 feet high. The culms are remarkably straight and free of branches for about half of their length.

Setting out bamboo in the Oriental Bamboo Nursery, Pichilingue.

In addition to the large culms, small ones having a diameter of less than an inch but a height of sometimes 25 feet are found in young plants and, frequently, as suckers that spring from the stumps of felled mature culms. Under forest conditions they take on the characteristics of climbing plants. These supply poles for various uses, such as props for fruit trees and for clothes lines, fruit-harvesting poles, and for furniture.

This species of bamboo occurs in the lowlands in at least two forms, called locally *caña brava* and *caña mansa*. *Caña brava* (*brava* means fierce or aggressive) is characterized by a relatively greater development of branches at the base of its culms and by a formidable armor of spines on these long wiry branches, making access to the plant difficult, even for an expert armed with a sharp machete and sandals. *Caña mansa* (tame, gentle, soft), on the other hand, has fewer and weaker basal branches, and the spines are less strongly developed. Its culm walls are generally somewhat thinner and of a softer texture. On account of the harder, more durable quality of its wood, *caña brava* is in greater demand than *caña mansa* and usually brings a slightly higher price. Reports at the Cooperative Experiment Station, Pichilingue, of the relative durability of the wood of the two strains when in contact with the soil indicate that sunning floors paved with boards of *caña mansa* last 2 years on the average while those paved with *caña brava* last about 3 years.

The distribution of the two strains appears to be about equal, *brava* being dominant in some areas, *mansa* in others. No correlation between distribution and any local ecological factor has been found. The pattern of distribution may be entirely accidental or it may depend upon the human factor of greater intensity of harvesting.

Cultivation

Bamboos are rarely cultivated in Ecuador. In the areas where they flourish, their natural growth supplies both the existing local needs and the demand from outside, though I have been unable to obtain information on the yield

Dr. McClure, Field Service Consultant on Bamboo for the Office of Foreign Agricultural Relations, is spending a year in the West Indies and in Central and South America studying the possibilities of developing bamboo as a complementary crop.

Houses and fence made principally from the culms and *tablas* of *Guadua angustifolia*.

per unit of land secured from the natural stands. Into those areas where they do not occur naturally the culms and boards are imported.

Instances of cultivation of bamboo in Ecuador are not numerous. F. G. Von Buchwald, an old resident of Quevedo, says that he once made an experimental planting of *caña mansa*. He used cuttings, embracing 6 or 7 internodes, of full-size culms 5 to 6 inches in diameter, 1 year or less of age. He put them in during December at the beginning of the rainy season, and about 90 percent of them took root and grew. At the age of 7 years the plants appeared to have reached their full development. Cultivation of *guadua* was initiated recently in the northern coastal Province of Esmeraldas. Professor M. Acosta Solis states that young canes, even fleshy shoots, are employed for propagation. A. Valero, Ecuadoran Agronomist, claims to have successfully grown plants of *Guadua angustifolia* by means of basal branches taken from the culm in a half-developed condition and still encased in their sheaths.

Guadua angustifolia appears to reach its best development on well-drained soils in the humid portions of the lowlands of Ecuador. This is contrary to my personal impression of the requirements of this species, based on observations in Colombia, where wet soils seemed to be preferred, as reported in the January 1945 issue of *Agriculture in the Americas*.

Use in House Construction

The principal use made of bamboo in Ecuador is in the building industry. The framework of most buildings is of hardwood, but the walls, partitions, floors, rafters, and sheathing are commonly constructed of bamboo. The roofing material in rural areas is usually a thatch made of the leaves of *bijao* (*Heliconia bijao*) or of *toquilla* (*Carludovica palmata*), both abundant in the humid lowlands. More pretentious structures are roofed with corrugated iron, pressboard of vegetable fiber, or clay tile.

The usual covering of the walls, partitions, and floors is bamboo in the form of long, thin, board-like sheets called *tablas*, or *caña picada*. These *tablas* are made by opening out flat the separate cylindrical bamboo culms. The operator, called *picador*, holds the *culm* in position on the ground with his foot and strikes the blade of an axe into each node at intervals of an inch or so right around the culm. The incisions in the different nodes are short and entirely independent, so that the wall of the culm clings together as a fabric in spite of the great number of splits with which it is rent.

When every node throughout the length of the culm has been cracked in this way, the *picador* makes a single continuous split from one end of the culm to the other. The culm opens out and may be pressed flat. The boards thus made are stacked, first one with the inner surface up, then one with the outer surface up. The stack is weighted with stones to prevent curling, and the boards dry out flat.

In covering floors, walls, and partitions, the boards are fastened in place by narrow strips of bamboo, about 2 inches wide, nailed to the frame. To avoid splitting, holes to accommodate the nails are made through the hard outer layer of the bamboo strips with the point of a machete.

The lasting quality of these bamboo boards seems phenomenal. Their life expectancy is commonly given as 15 to 30 years, even in humid areas. I saw one house on the estate of the *Corporación Ecuatoriana de Fomento* at Pichilingue whose walls and partitions of bamboo boards, installed 40 years ago, were still relatively intact.

Where appearance and weatherproofness are considerations, the bamboo walls are sometimes stuccoed with concrete. The stucco may be applied directly to the bamboo or to a network of barbed wire attached to the bamboo.

A very attractive type of cottage, in which large bamboo culms are used in a manner to suggest a log cabin, is at

Bamboo grows well in the lowlands of Ecuador.

Bamboo *cerca*-type fish trap on the Palenque River, Los Ríos.

present the center of a good deal of popular interest in Guayaquil. Prefabricated panels, consisting of large culms set in close order in wooden frames, constitute a building material which, together with the conventional *tablas* or bamboo boards, is exported in considerable quantities.

Furniture

A small building and furniture industry, based on a more or less radical departure from the architectural conventions current in Ecuador, has recently been started in Guayaquil using bamboo alone or with various kinds of wood. The chairs, lounges, tables, buffets, cribs, and many other articles of furniture are as yet rather heavy because the canes used are large. When commercial quantities of the smaller culms of Oriental species, recently introduced into Ecuador for experiment, become available, furniture of a lighter type may be produced.

Fish Traps

A novel use of bamboo is observed in the Province of Los Ríos. Two kinds of fish traps, called *albarradas* and *cercas,* are made from bamboo culms. *Albarradas,* meaning walls, are automatic traps used during the dry season on small streams from 10 to 20 feet wide. They are erected in places where the stream has precipitous banks and a mud bottom. They consist of a barrier of stakes driven closely across the stream bed, a back-stop, and a platform upon which the fish fall when they attempt to leap over the barrier. The catch occurs principally on dark nights.

Cercas, meaning fences, are small rectangular enclosures made of long bamboo strips driven into the mud along the edge of a stream. A sliding guillotine-like door, weighted with a stone, is operated personally by the fisherman when the fish have been enticed within the enclosure by bait. *Cercas* are operated principally during the daytime.

Sunning Floors

The sunning floors used for the drying of farm produce such as rice, corn, manioc (yuca), coffee, and cacao are of two types. The commoner one, called a *tendal,* is built directly on the ground and is paved with *tablas,* or boards, made of *Guadua angustifolia.* The *corredizo* is a special type of elevated sunning floor used where sudden showers occur. It is a rectangular framework of bamboo, one half of which supports a sunning floor covered with bamboo *tablas* several feet above the ground. Surmounting the whole rectangle are three bamboo poles arranged like the ridge pole and eave poles of a roof. They serve as a track upon which a light roof of bamboo thatched with *bijao* leaves (*Heliconia bijao*) can be moved easily. In case of rain this roof is moved quickly along the track to cover the sunning floor. In fair weather it is pushed back over the other half of the rectangle.

Cacao-harvesting Poles

The Ecuadorans use bamboo in almost countless other ways around their farms or town homes. One important use is for harvesting cacao fruits from the trees. For this purpose, a bamboo pole 25 feet long and from three-fourths to seven-eighths of an inch in diameter, with a chisel-like knife attached to the tip, is used.

Drinking Water

In areas where *Guadua angustifolia* occurs in abundance, it constitutes an important source of drinking water during the long dry-season. Wells are few and sources of safe drinking water are scarce. Along the trails one finds that a high percentage of bamboo culms have been tapped at five or six of the lower internodes or joints. Healthy uninjured plants yield water that is fresh, cool, and altogether a pleasant drink, with almost no perceptible flavor. Some people believe, however, that continued excessive use of this water may cause inflammation of the bladder.

Oriental Species Introduced

A number of species of bamboo originally from China, Japan, India, and Java, have recently been introduced into

(*Continued on page* 194)

Covered bridge with floor made of *Guadua angustifolia.*

Cuba's Plant Scientist

Dr. Juan Tomás Roig y Mesa has spent most of a long and useful life studying the plants of Cuba and introducing new plants for the economic welfare of the Island.

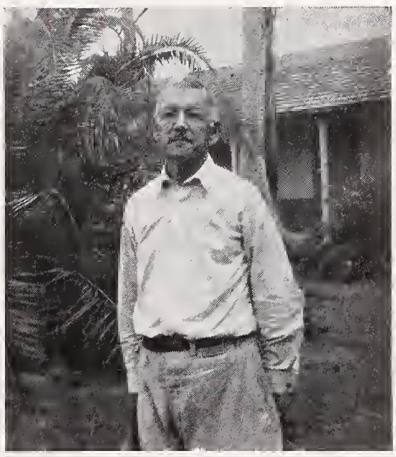
by C. A. BOONSTRA

At the *Estación Experimental Agronómica* in Santiago de las Vegas, near Habana, a 68-year-old scientist continues the labors which have brought him renown as Cuba's outstanding plant scientist. Botany, academic and economic, has been the life-long profession of Juan Tomás Roig y Mesa and his personal hobby as well.

He was born on May 31, 1877, at Santiago de las Vegas, Cuba. His grandfather had been one of the town's early settlers, coming as a physician with Spanish troops. In 1894 the Roig family sought refuge in the United States to escape from the military turbulence of the Island.

This interrupted the cigar making which the boy Juan had learned in Cuba in order to gain a livelihood, and initiated for him a new life occupation of study and research. During this time he studied English, even spending a few months at Harvard University, in 1901, improving his knowledge of the language.

After the republic was established, the Roig family returned to Santiago de las Vegas. Juan took with him an awakened interest in gaining knowledge. Back in Cuba, he entered the University of Habana and worked zealously through the curricula of various departments, tending gradually toward specialization in agricultural and natural sciences. Courses in pharmacy and in botany fostered an interest in medicinal plants and herbs. Not until 1912, when he received the Degree of Doctor of Science, did he consider his formal studies terminated. During all these years he paid his expenses by making cigars and by teaching in public schools.



Visitors to the *Estación Experimental Agronómica* find Dr. Roig anxious to cooperate in the identification and distribution of plants.

Recognized Plant Scientist

Formal recognition as a plant scientist came to Dr. Roig in 1916 when he was appointed to take charge of the botanical work of the agricultural experiment station near his home in Santiago de las Vegas. Although later engaged in teaching and in other government work, Dr. Roig has remained since 1916 closely associated with the *Estación Experimental Agronómica* and with his boyhood home.

Dr. Roig is known particularly as a prodigious classifier of flora, exploring the relatively untouched Cuban field. His best-known work, the *Diccionario Botánico de Nombres Vulgares Cubanos* (Botanical Dictionary of Common Cuban [Plant] Names), was published in 1928, and since then has been the official guide for identification and description of Cuban plants. In connection with this work, Dr. Roig collected plant specimens which today are the basis of a private herbarium numbering more than 10,000 species.

The first volume of another major botanical work, *Plantas Medicinales, Aromáticas o Venenosas de Cuba* (Medicinal, Aromatic or Poisonous Plants of Cuba), has been published this year. A second volume is ready for printing, making available to agricultural science the results of many years of work with these plants.

Introduction of New Plants

Introduction of new plants has been one of Dr. Roig's favorite labors. The ramie which grows in Cuba today was introduced by him 30 years ago, at which time he was making investigations of the possibilities for growing various kinds of fiber in Cuba, such as ramie, malva, sansevieria, and several plants native to the island. From Trinidad and Jamaica he brought bananas and plantains in attempts to establish strains resistant to the destructive sigatoka. Although commercially unsuccessful for this latter purpose, his introductions have provided the basis for much experimental work. A recent importation has been ginger root from Jamaica, which is proving to be well adapted to growth in Cuba. The flowering *cidrão,* which he brought from Brazil, has spread widely through Cuba, being propagated by beekeepers to help boost honey production.

Numerous other ornamental, medicinal, and aromatic plants have been brought from the corners of the world

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into Dr. Roig's herbarium and into his experimental plots, where he has assembled thousands of plants for use in research. Seed and plant samples fill all available space in his office, and he spends much time in selecting, cleaning, and preparing seed of medicinal plants.

Interest in Foreign Agricultural Research

Through his studies and through his wide acquaintance among plant scientists, Dr. Roig has developed a deep interest in the agricultural research of other countries, especially in the Western Hemisphere. His travels have taken him to the United States, Brazil, Mexico, and through the West Indies, and one of his principal occupations today is the maintenance of extensive correspondence with numerous scientists who desire the benefit of his knowledge of the flora of the Caribbean area. Fluent use of the English language enables him to make a further contribution to science through translation into Spanish of useful materials from the United States Department of Agriculture. Visitors to the *Estación Experimental Agronómica* find him eager to cooperate in the identification and distribution of plants.

Today Dr. Roig approaches his work with unabated energy and enthusiasm, and he is mapping out projects for future years. In his files at present are almost complete data for a revised edition of the *Botanical Dictionary,* incorporating another 1,000 plant descriptions. Simultaneously, data are in process of assembly for a general textbook on forestry and also for a bulletin on the ecology of the cedar tree in the Caribbean area. Each of these works is cxpected to contribute substantially toward the more adequate development of plant science in tropical and subtropical countries.

IN-SERVICE TRAINING

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the idea has taken such firm root and is spreading among the farmers of the whole community. The soil is very fertile, though rocky, and the terraces are a combination in most instances of our old hillside ditch and terrace with the terrace being constructed of rock instead of earth. They just gather the rocks off the land and perform the double purpose of land clearing and building a terrace all at one time.

What Does the Balance Sheet Show?

What is the balance sheet? Out of the 25 men of the class of 1942-43, 20, or 80 percent, are actively at work, of one kind or another, helping their country save its soil and better its agriculture. Of this present class of 12 men, it is practically certain that 10 of them will carry on conservation work for their respective governments. This is also a percentage of 80.

The Soil Conservation Service is proud of these accomplishments and of the fact that it has been instrumental, through the trainee class of 1942-43, in helping to improve farming methods through the adoption of soil- and water-conservation methods in 11 American republics.

With the return, this summer, of the class of 1944-45, five more countries will begin to carry out proper use of their agricultural lands through the efforts of the men who have been learning conservation techniques.

Weighing these results, the Department of Agriculture feels that this training program is one of the best investments in better agriculture, and that the program could be expanded greatly, to the advantage of each South and Central American country, and of the United States as well.

BAMBOO

(*Continued from page* 192)

Ecuador. These species, selected especially for the superior quality and technical versatility of their culms and for their relatively low susceptibility to attacks of the powder post beetle, are expected to prove of value in meeting certain needs which cannot be satisfactorily filled by *Guadua angustifolia.*

The plants have been set out at the *Estación Experimental Agrícola del Ecuador* at Pichilingue, in Los Ríos Province, where observations on their response to local conditions will be made. When available, plants will be distributed to collaborators in various parts of Ecuador for more extensive trials and for eventual production on a commercial scale where conditions appear favorable.

CONFERENCE

(*Continued from page* 186)

quantity of substances used in the enrichment of exported wheat flour, labeling of textiles to indicate the nature and percentages of raw materials used, and the general adoption of uniform quality standards, grades, and packing specifications, together with the necessary official machinery of inspection and enforcement.

Inter-American Collaboration

Many of the resolutions affirm the importance of inter-American technical collaboration to facilitate expansion and scientific development in agriculture. Resolution XXXIII endorses the bilateral approach, which has been followed by the United States in its cooperative experiment station agreements with other countries, and recommends that such collaboration continue to be promoted, "giving it as large an inter-American character as possible." Resolution LXII makes substantially the same recommendation for cooperation as applied to experimentation.

New Societies and Future Meetings

The Conference approved the creation of an Inter-American Society of Soil Science (Resolution LII). Also proposed were an Inter-American Society of Agricultural Climatology (Resolution LIII), to be created at the next Inter-American Conference on Agriculture; the holding of an Inter-American Conference on Conservation of Natural Resources (Resolution LV); the founding of an Institute of Veterinary Investigation (Resolution XLII); and the holding of an Inter-American Forestry Meeting (Resolution XLVIII).

Immigration and Agricultural Colonization

Ten resolutions of the Conference deal with problems of immigration and land settlement. These are concerned, for the most part, with measures of a national character needed to assure success of any colonization programs undertaken. Resolution LXXIX recommends that the American governments agree upon general measures to guide postwar immigration along lines harmonious with our environment, our economic needs, our culture and democratic ideals "without racial, language, or religious prejudice."

Pan American Union Receives Many Additional Duties

In addition to those duties already established, the Pan American Union is charged with a large number of added responsibilities. New sections in the Pan American Union, according to the resolutions, would include: Migration and colonization; agricultural credit; recommendations of the Conference on production and consumption; forestry; and an Institute of Veterinary Investigation.

The Pan American Union is also requested to make studies of educational facilities for agricultural instruction in the various republics, prepare a roster of scientific personnel in agriculture and related sciences in the Americas to stimulate greater technical collaboration, contact all countries with respect to uniform grades and labels, and make studies toward the establishment of a Pan American Award for Merit in Agriculture.

In addition to the responsibilities delegated to the Pan American Union, the Inter-American Institute of Agricultural Sciences is requested to organize a research department in agricultural machinery, and to investigate the possibilities of correlating curricula in agricultural and veterinary schools.

Addresses and Remarks

The Conference was opened by General Isaías Medina A., President of the United States of Venezuela, and the inaugural address was delivered by Dr. Angel Biaggini, Minister of Agriculture and Animal Husbandry of Venezuela, who served as President of the Conference. The closing address was made by Ing. Marte R. Gómez, Secretary of Agriculture and Development of Mexico, and head of the Mexican delegation. Closing remarks were also made by José Muñoz Pas, Chargé d' Affaires of the Bolivian Embassy; José L. Colom, Chief, Division of Agricultural Cooperation, the Pan American Union; and Leslie A. Wheeler, Vice Chairman of the United States delegation.

Probably the best summarization of the feeling at the close of the Conference was made by Mr. Wheeler, when he said:

"I have attended many international gatherings in many lands. But this one will always be outstanding in my mind because of: First, the strong spirit of friendship and the earnest desire of all delegates to find a basis of agreement; Second, the evident appreciation of all of the seriousness of the problems we have been dealing with. This Conference will not solve these problems. But it points the way to their solution . . . ."

ALONG THE *Agricultural Front*

▲ Interest in 5-C Program Increases in Cuba

As part of an intensive campaign to improve food production and in an effort to bring greater educational opportunities to farm boys and girls, interest in 5-C Club work has definitely increased in Cuba. This was recently manifested in an impressive exhibition by 5-C Club members, held in the Capitol Building in Habana.

The exhibition lasted three days and was the largest ever put on by the 5-C Clubs. More than 2,000 entries of grain, vegetables, fibers, handiwork, industrial products, and wood collections were included.

The 5-C program in Cuba was established by the Department of Agriculture of that country in 1931 and has much the same purpose as the 4-H Club program in the United States, after which it was closely patterned. At present there are more than 350 5-C Clubs with a total membership approximating 15,000.

▲ Fertilizer Factory Considered in Ecuador

Plans have been disclosed for the construction, near the port of La Libertad, Ecuador, of a factory for the production of fertilizers. The project, which has been under consideration for some time, now seems feasible because of the discovery of a deposit of guano on the small island of El Pelado, located about 16 miles off the Santa Elena Peninsula.

The Department of Industries and Mines in the Ministry of Economy has been studying for some time the problem of supplying locally the need for fertilizers to improve the soils in Ecuador. This material is reported to be impregnated throughout with a great quantity of phosphates and of phosphorites in the form of rounded crusts similar to chalcedony. Analyses of various samples show that the percentage of phosphoric anhydride varies from 25 to 40 percent, almost all of which is said to be in an assimilable state, or soluble in a weak concentration of citric acid. To exploit this deposit, installation of crushers and machinery to give the phosphates the required fineness will be necessary.

La Libertad is also reported to be near an abundant deposit of limestone containing phosphates. Ovens will be needed to transform the calcium carbonate into the more convenient form of calcium oxide. This substance would be useful in correcting soil acidity that is prevalent in the greater part of the cultivated sections in the sierra region.

▲ New Bath Reduces Decay in Citrus Fruits

From a horticultural laboratory and citrus packing plants in Florida comes the announcement of a new bath which greatly reduces decay losses in citrus fruits and leaves the skins of the fruit clean and attractive.

At first, the bath with which experiments were made consisted of sodium ortho-phenyl-phenate. This stopped the decay, but it injured the rinds of the fruit. Then experimenters found that formaldehyde added to the bath corrected the fault. The resulting mixture, made up of 37 percent standard formaldehyde and 63 percent of sodium ortho-phenyl-phenate, is applied to the fruits in a warm flood spray or bath. Such small quantities of the mixture are left on the skins that no special washing is necessary. Repeated tests have proved this process to be satisfactory.

▲ Panama Encourages Poultry Raising

During the first seven months of 1945 the Panamanian Department of Agriculture imported nearly 12,000 fowl for breeding purposes, including ducks, and hens and cocks of such well-known breeds as White Leghorn, Barred Plymouth Rock, Long Island Red, and New Hampshire Red, in order to encourage poultry raising in Panama. A liberal policy has been followed in the prices of chicks for distribution.

The present great demand for the imported poultry and for poultry feed indicates that the farmers of Panama are instituting modern methods in the raising of poultry.

RIVER BASINS

(*Continued from back cover*)

About 91.5 percent of the 5,032,500 inhabitants in Chile (1940 census) are clustered in and around the Central Valley, where the river valleys make agriculture important. Santiago is the largest city, with a population of approximately 852,000.

The fourth zone, or southern Chile, is largely insular. The valley gradually falls away and the Coast Range is transformed into a vast archipelago extending along the coast to Cape Horn. The rivers of this region have steep rocky slopes and storm-tossed waters fed by heavy rains.

Climate

In Chile many types of climate exist. Going from west to east, one may pass from a temperate climate at the mouth of the rivers to icy peaks in the Andes where the rivers have their origin. The average temperature of the country is lower than that in corresponding latitudes in the Northern Hemisphere because of the cold Humboldt Current which flows along the coast from south to north.

The climate in the northern zone is dry and hot, with temperatures as high as 91° F. and rain falling only once in several years. The Central Valley and the coast between 32° and 36° S. latitude have a delightful climate, the temperature seldom rising above 77° or falling below 32° F. The annual rainfall varies from 17 to 43 inches. This Valley, the agricultural section of Chile, is somewhat similar to the coast of the State of Washington in the United States, but with seasons reversed. The average temperature, however, is somewhat cooler than in Washington as there is no warm ocean current to modify it. In southern Chile the annual rainfall reaches 200 inches in certain localities. Rain falls almost every day, especially in winter, the heaviest rainfall occurring at about 41° S. latitude in the lower end of the agricultural zone.

There are really only two seasons in Chile, the wet and the dry. The wet season occurs during winter, the months of April to October in the southern section and May to August in the northern.

Soil

The soils of the majority of the river basins in the agricultural section are well mixed and exceptionally fertile. Deep deposits of silt, sand,

gravel, and boulders brought by the numerous streams from the Andes spread out in alluvial fans. Along the higher edge of the piedmont slope, the material is coarse and poorly sorted, but a short distance from the mountains the deposits are covered with a layer of rich dark soil. In the center of the Valley the underlying gravel is fine and is buried many feet deep under accumulated silt and humus. These well-drained soils afford the best farming land. The deposits along the western border of the Valley are of still finer texture, so small-grained that the soil is almost impermeable to water. The whole Valley floor is an alluvial fill, so deep that its fertility is virtually inexhaustible. At Santiago borings indicated alluvial deposits of more than 300 feet.

Vegetation and Resources

Vegetation is practically nonexistent in the north, beyond 30° S. latitude, and mineral products form the main resource. From the Peruvian border to about 21° 30′ S. latitude sodium nitrate is mined. Gold, silver, and copper are mined farther inland. Only in scattered oases, such as Calma on the Río Loa, where irrigation is available, are small grains, fruits, and vegetables grown to a limited extent.

In 1925 a warm ocean current which usually lies far out to sea suddenly expanded and reached the coast of Chile. The incoming winds brought a great amount of moisture, and rain fell torrentially as far as 200 miles inland day after day for several weeks. In the desert, green carpets of grass appeared, while in the ocean millions of dead fish were reported to be floating, poisoned by the soluble nitrate and copper which the newly created streams had carried to the sea.

The chief resource of the second zone also is mining. Copper and silver are abundant, and gold, cobalt, nickel, lead, iron, and manganese are found. Some agriculture flourishes along the rivers. A ribbon of cultivated land nearly 90 miles long extends through the Río Copiapó Valley. The Valley was once famous for copper and silver but is now irrigated and abounds in fruit trees, vineyards, and grain fields. In the Valley of Río Guasco, in Atacama Province, irrigation watered about 4,000 acres of barley, corn, and wheat in 1941. The same year, irrigated valleys of the Elqui, Linan, and Choapa Rivers, in Coquimbo Province, had over 100,000 acres in wheat, barley, beans, corn, potatoes, and lentils, as well as about 7 percent of Chile's goats, sheep, and cattle.

The third zone, Central Chile, with its many rivers and its fertile soil, is a section of great agricultural production, together with manufacturing industries. It embraces approximately 65,000 square miles, nearly the size of the State of Washington.

The broad valley of the Aconcagua and Putaendo Rivers, a veritable Garden of Eden, has fields of grain and alfalfa, abundant orchards and vineyards. This is a leading tobacco area, and contains more than 10,000 acres of beans, *lentejas* (small, black, flat beans), potatoes, and other vegetables. South of the Río Bío-Bío large productions of wheat, oats, potatoes, *arvejas* (green peas), and grapes are reported. The largest numbers of cattle and hogs are produced in Caulin Province, and the largest potato acreage is in the island of Chiloé. Fruit, a principal export from Chile, grows wherever agriculture is practiced.

The fourth, or southern, zone is the only frontier left in Chile today. Rain is abundant, and there are extensive virgin forests. Coastal waters provide profitable fishing, and pastures are good for cattle and sheep. In the enormous grasslands of Chile's two southernmost Provinces more than 2,000,000 sheep graze on ranches that stretch back in the interior and average around 25,000 acres.

Although agricultural crops dominate, particularly in the Central Valley, forests play an important part in the vegetation of the country. Even in the Central Valley many uncleared spots of chaparral, similar to the shrubs or dwarf trees of southern California, are found. Willows along the streams, and, in the narrow canyons along the foot of the mountains, stands of *peumos* (a tree of the Laurel family) growing from several inches to a foot in diameter and from 20 to 30 feet in height, furnish farmers with fuel, fence poles, and material for building homes and implements. Abruptly below the Bío-Bío River, irrigated fields on sloping alluvial fans give way to clearings in the midst of forests, and forests become denser and denser the farther south one goes, as the rainfall grows heavier. Lumber, which has begun to figure in foreign trade, may become as important an export item as fruits are today.

Up in the mountains, even shrubs do not grow above 5,000 feet, and beyond 8,000 to 9,000 feet grass stops. It is just one rocky slope after another until perpetual snow is reached.

About 5 percent of Chile's 58,000,000 acres is arable land, comprising some 202,000 agricultural properties. Chilean agriculture is still an agriculture of large holdings, many estates having 12,000 or more acres. Sixty percent of the arable land is held by less than 600 families. Less than 2 percent of the land is in farms up to 50 acres in size.

Transportation

Because of heavy breakers and lack of harbors along the northern coast of Chile, ocean vessels ride at anchor half a mile or more off shore, and connections with land are by means of small boats. The busy port of Puerto Montt, however, is reached by steamer through a magnificent "Inside Passage" reminding one of Alaska's similar passage.

Inland, the rivers offer easy transportation by boat between many localities. The Imperial, Valdivia, Maule, and Bueno Rivers are navigable for small steamers in their lower courses.

Many places are dependent upon railroads or cable lines. In the north a railroad connects Arica with La Paz, Bolivia. Another line extends from Pisagua in the north to Castro in the south. Transverse lines transport products between the interior and the ports. A railroad crosses Chile from Valparaiso on the coast to Punta de Vacas across the Argentine border, and another one is under construction from Antofagasta to Socompa Pass.

Highways follow the general pattern of the railroads and apparently are continuations of the old Indian and Spanish trails.

Conclusions

In the past, the mineral industry has been the real contributing factor in the development of the country. Chile's future would seem to depend on a more evenly balanced economy based on agriculture, lumber, and minerals. Fuller utilization of the rich agricultural lands in the many river basins of the Central Valley and greater development of the natural resources of southern Chile would seem to be vital. This does not mean expansion of the area of farm land but rather more production from the present area.

Plants and Plant Science in Latin America, edited by Frans Verdoorn. 384 double-column pp., 83 plates. The Chronica Botanica Company, Waltham, Massachusetts (G. E. Stechert and Company, New York City), 1945. Volume 16 of "A New Series of Plant Science Books."

Nearly 100 articles by more than 90 scientists and experts of North, Central, and South America are included in this book. The general articles deal with such topics of agriculture, forestry, and phytopathology as: Some problems of tropical American agriculture; principal economic plants of tropical America; plant pathology in Latin America; climatology and meteorology; soil conservation; food aspects in Latin America; Hevea rubber culture; cinchona culture; production of essential oils; fruit production in South America; and plant breeding, genetics, and cytology in Latin America. About 50 articles are devoted to the vegetation and plant resources of the various Latin American countries.

The many plates, extensive bibliographies, and lists of plant-science institutions, stations, museums, gardens, societies, and commissions add to the value of the book as a source of agricultural information.

Makers of Democracy in Latin America, by Harold E. Davis. 124 pp. The H. W. Wilson Company, New York, 1945. This is a series of 24 brief biographical studies of political leaders who, the author believes, "contributed to the great tide of liberal reform" in the Latin American republics.

The book is divided into three parts: Part I, "The Movement for Independence," beginning with such early leaders as Francisco de Miranda, Simón Bolívar, and José de San Martín; Part II, "Nineteenth Century Liberals"; Part III, "Makers of Democracy Today," closing with Lázaro Cárdenas. A bibliography at the end of each 2- or 3-page biography, and a detailed index add to the value of the book.

Mexico's Role in International Intellectual Cooperation. 60 pp., illus. The University of New Mexico Press, Albuquerque, New Mexico, 1945. No. VI of the Inter-Americana short papers of the School of Inter-American Affairs, covering the proceedings of the Conference held in Albuquerque February 24-25, 1944, under the sponsorship of the University of Texas and the University of New Mexico. It contains the lectures given by various speakers, dealing with such subjects as "The Indigenous Cultures of Central Mexico," "The Importance of the Study of English and Spanish in the International Relations of Mexico and the United States," and "The Basis and Significance of Relations between Mexico and the United States."

Greater Good Neighbor Policy, by Wade Crawford Barclay. 257 pp. Willett, Clark & Company, New York, 1945. The author presents factually the social and religious situation in Latin America. He believes that cooperation among Christian forces "supplementing all that government can do and working on a deeper level" is essential to the true inter-American unity sought in the Good Neighbor Policy.

Our American Neighbors. 280 pp., illus. Public Affairs Press, Washington, D. C., 1945. The pamphlets dealing with 20 Central and South American and Island republics, published by the Office of the Coordinator of Inter-American Affairs during 1943 and 1944, have been collected in this book. Several of the pamphlets have been brought up to date and certain minor errors corrected. The history, achievements, economic characteristics, and cultural contributions of each country are told and illustrated in a chapter devoted to that country.

Cinchona in Java, by Norman Taylor. 87 pp., illus. Greenberg, Publisher, 400 Madison Avenue, New York, 1945. The author relates briefly the discovery of how malaria is transmitted and then tells the story of quinine—the discovery of cinchona in South America, the attempts to establish its cultivation in the Old World, the final establishment in Java of the *Cinchona ledgeriana,* and the industry as it is carried on by the Dutch in Java today.

Glossary of Cuban Woods, by Juna de Dios Tejada y Sainz. 29 pp. El Foro del Traductor, Santa María del Rosario, Cuba, 1945. This pocket-size pamphlet gives the names in Spanish of Cuban woods of commercial importance, with their English equivalents, scientific names, brief description, weights per cubic foot, and major uses.

EDITOR'S NOTE.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

AGRICULTURE IN THE AMERICAS O. R. CARRINGTON, EDITOR

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Gifts of the Americas

MANGROVE BARK

by MARJORIE FRYCKBERG

"If you can't be beautiful, be useful," a popular saying in grandma's day, aptly describes the American, or red, mangrove tree (*Rhizophora mangle* L.). Growing in a weird dense maze in black oozy mud on a tangle of stilt-like roots with a bushy top of thick, leathery leaves, the mangrove definitely is no beauty; but because it is rich in valuable tannin, it is the basis of a steadily growing industry in Central and South America and an important export trade to the world.

The importation of mangrove bark from Central and South America was 4,653,991 pounds in 1944. In the first six months of 1945, this country has already imported 750,491 pounds of solid mangrove extract, more than eight times the amount imported in 1942. In Brazil, Colombia, Ecuador, and Venezuela new companies are utilizing the bark for exportation and the leaves, which deteriorate rapidly, for local tanning.

Tannins are chemical compounds which unite with the fibrous protein of dehaired animal skins to produce leather. Some are used with goat or sheep skins to produce soft leathers. Others are used alone or in mixtures to tan and fill heavy cattle hides for use as shoe soles or machine belts. The extract of mangrove bark, which imparts a reddish color, is used in blends to produce sole leather. It aids in producing plump leather of good weight yields.

Tanning is as old as the pyramids, the first known reference to leather being carved on stone 5,000 years ago. The Egyptians valued it with gold, and our term "pecuniary" comes from the Latin *pecus,* "the hide." Specimens of leather 33 centuries old have been unearthed in perfect state of preservation. American Indians were expert tanners.

Rhizophora mangle grows throughout the vast salt-water swamps and tidal rivers of tropical America within 20° of the Equator from southern Florida and Baja California to central Brazil. It prefers warm sheltered coves for protection from violent winds, which shake it to death, and from cold, which kills it at 25° F. Some trees reach a height of 100 feet, though the average is 30 to 40 feet. Some are 7 feet in circumference and have bark an inch thick.

Its peculiar growth habits have nicknamed the mangrove "land builder." It usually takes root where the ocean or river bottom is submerged only at high tide; mud accumulates around the tangled roots until it finally smothers them; the mangrove then ceases to grow, and dry-land plants take root. Within 12 years a mangrove swamp can become sufficiently solid to permit the planting of coconut trees. About 1,500 acres of new mangrove swamp have appeared in the Biscayne Bay area of Florida during the last 30 or 40 years.

When the somewhat bean-like leathery fruit, said to make a wholesome light wine, is still hanging on the boughs, long weighted radicles emerge from the seeds and descend rapidly to the oozy mud beneath, establishing a new growth. Some seeds are provided with a device enabling them to float upright a thousand miles and still remain viable. Minute openings in the aerial roots allow air to penetrate into the spongy tissue of the sub-surface roots. Even the aerial roots are used by natives who find them arched just right for ribbing boats. The durable, hard, and heavy wood, usually dark red at the heart when mature, is used for posts, fuel, and in construction.

Harvesting mangrove bark is done by workers who penetrate the dense swamps in small boats, cut the trees at low tide, strip the bark, and transport it to drying sheds. After several weeks of drying, the bark is ground into fragments of varying size and is sent to the tanneries or shipping points.

The bark is cooked in copper extractors until a liquor results. This is evaporated, leaving a brittle solid with a vitreous luster and dark red color. To modify this color and to secure desired leather properties, mangrove is usually blended with hemlock, oak, or mimosa. Commercial mangrove bark extracts contain about 55–58 percent tannin; the leaves, from 21 to 48 percent.

Mangrove is available in almost limitless quantities. The president of a company which recently began operations in Pará, Brazil, estimates that 10,000 tons of mangrove bark could be extracted annually for an indefinite period in his area.

The world needs leather. Although the United States alone produces more leather than all of Europe, including the United Kingdom, its supply of natural vegetable tannins, chiefly oak, hemlock, and chestnut, is steadily diminishing. Before Pearl Harbor, about 60 percent of the tannin used in the United States annually was imported, of which 30 or 40 percent came from South America. Wartime interruption of trade with the Far East has turned the attention of tanners to Central and South America, and today the world can look to the vast mangrove swamps there as a potential reservoir of shoe-leather tannin. This is important, because leather has always played an essential part in the march of civilization.

RIVER BASINS OF CHILE

by **R. G. HAINSWORTH**

Numerous rivers find their outlet along the 2,630-mile Pacific coast of Chile. The crest of the Andes Mountains forms the eastern boundary of the country, the width of which ranges from 70 to 140 miles, except in the northern and southern extremities, where it widens to 250 miles. From the permanent snow fields of these mountains many rivers receive an ample supply of water, even during the dry summers. Originating in the mountains, they flow west, most of them across the Central Valley, and then are deflected by the coast hills until they find gaps which give outlet to the sea.

Chile may be divided into four zones, characterized largely by the presence or absence of rivers. The first zone, in the north, is a dry region extending from approximately 18° to 27° S. latitude. Here the Río Loa, supplying water for irrigation to a few agricultural communities, is the only river with sufficient headwaters to force its flow across this bleak Atacama Desert.

South of the Loa, the first surface water to reach the ocean is the Río Copiapó, in the second zone. Except for small fertile areas along its comparatively few rivers, this zone, like the first, is a mining area.

The third zone, comprising the Central Valley, is a major agricultural area, and across this fertile valley most of the rivers of Chile flow. It is divided by spurs of the Andes into basins, in some cases completely separated from one another, especially between Santiago and Concepción. The valley of Río Aconcagua, known as the Vale of Chile, as an example, is isolated from the valley of Río Mapocho, in which Santiago is located, by a mountain spur requiring a climb of about 2,600 feet in crossing from one basin to the other. The valley of the Aconcagua River widens into a broad expanse at the point where the tributary stream Putaendo enters it. Between the Vale of Chile and the beginning of the desert at Coquimbo, the Andes and the Coastal Range are so close tgether that the basins of the Central Valley disappear.

(*Continued on page* 196)

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November 1945

NAMES & NEWS

Assigned to Cuban Experiment Station

Joe E. Walker, Agronomist, and *Edward L. Gordon*, Agricultural Engineer, Office of Foreign Agricultural Relations, have been assigned to the Cuban Agricultural Experiment Station where the U. S. Department of Agriculture is carrying on a cooperative project with the Cuban Government. Mr. Walker will be in charge of agronomic investigation work on fiber-crop production, and Mr. Gordon will be in charge of agricultural engineering work at the Station.

●

Uruguayan Educator Visits United States

Dr. Dante Bianchi, Director of the Agricultural School at San Carlos, Uruguay, is in the United States on behalf of his government for the purpose of making a study of fruit culture and diseases, with particular emphasis on peaches and apples.

●

Hambleton Returns From Guatemala

Edson J. Hambleton, Entomologist, Office of Foreign Agricultural Relations, has returned to Washington, following 3 months in Guatemala during which he assisted in planning an entomological program for the *Instituto Agropecuario Nacional*. He also assisted with control problems of insects affecting coffee in storage and other crops.

●

Assigned to Ecuador

Robert L. Pendleton and *Charles S. Simmons*, Soil Scientists, Office of Foreign Agricultural Relations, in cooperation with *Erlif V. Miller*, Soil Scientist permanently assigned to Ecuador, recently conducted a detailed reconnaissance soil survey in Ecuador to select proper soil areas for the production of various complementary tropical crops.

Studies Dairy Industry

Ing. Julio R. Jahn, Director of the Industrial Dairy School of Colonia Suiza, Uruguay, has been in the United States on a special mission from his government to make a study of the dairy industry. In addition to conferences with dairy and educational specialists in the Department of Agriculture and the Office of Education, Ing. Jahn visited dairy centers in Wisconsin and Minnesota.

●

Long Returns To Nicaragua

Lewis E. Long, Agriculturist, Office of Foreign Agricultural Relations, following a report to officials in Washington on activities at the Cooperative Agricultural Experiment Station in Nicaragua, has returned to that Station where he is in charge of extension work.

●

Señor Salvador Guerrero Visits Washington

Señor Salvador Guerrero, Vice President of the Nicaraguan Commission of the Inter-American Development Commission, visited this country recently to confer with officials of the Farm Security Administration and the Farm Credit Administration on problems relative to dairy cooperatives.

●

FEA and 4-H Clubs Studied by Cuban

Señor Enrique Sánchez Bello, Chief of the Office of Boys and Girls Agricultural Clubs, Cuban Ministry of Agriculture, came to this country this fall to study the organization of the 4-H Clubs and Future Farmers of America.

●

Jasen R. Swallen Goes to Brazil

Jasen R. Swallen, Botanist, Division of Plant Industry, Soils, and Agricultural Engineering, has been assigned to Brazil for 1 year to assist the *Instituto Agronómico do Sul* at Pelotas in carrying on research in agrostology. Mr. Swallen is being sent to Brazil under Public Law No. 63 of the Seventy-sixth Congress, which provides for the temporary detail of USDA employees to governments of the American republics and the Philippines.

Agriculture IN THE *Americas*

Vol. V · NOVEMBER 1945 · *No. 11*

Coconuts in Tropical America

Shredded for cakes and candy, dried to make copra for coconut oil, and broken open for the cool milk inside, coconuts are the basis of an expanding industry in the Americas.

by DOUGLAS M. CRAWFORD

"Man's most useful tree" is the appropriate tribute paid to the graceful coconut palm by people living in tropical coastal regions and islands throughout the world. Easy to grow and producing fruit during more than half a century, the coconut palm (*Cocos nucifera*) helps to provide the necessities of life for millions of people living in the tropical belt extending between 20° and 25° north and south of the Equator. In this warm-climate zone all parts of the palm are utilized in some manner or other. The nuts furnish food, drink, a fiber called coir, and, when dried, copra, which is a source of oil. The tree provides material for construction and for household equipment.

In the Americas wild coconut palms flourish on the tropical coasts of many countries. On the eastern coast they extend from the State of Veracruz in Mexico all the way around the northern edge of South America down through the State of Bahia in Brazil. From the western State of Nayarit in Mexico they are found bordering the

Courtesy of Pan American Union

Workers climb barefoot and without belt or ankle rope to remove old leaf bases and trash from the coconut palm.

Pacific Ocean south to Ecuador. Coconut palms dot the numerous islands of the Caribbean Sea and appear in great numbers in the Lesser Antilles, especially in Trinidad and Tobago. While coconut palms normally grow near or on seacoasts, fairly extensive groves are reported inland in the Republic of Paraguay.

As is characteristic of tropical plants, the coconut tree thrives in areas which have mean annual temperatures of 72° F. or higher. Further, it demands copious amounts of rainfall, 40 inches well distributed throughout the year being considered a minimum. In many of the best-known coconut countries the average rainfall is double this amount. A circulating ground-water supply is another important requirement. Stagnant ground-water conditions cause harm to the palm and at times even kill it. Usually coconuts are planted on coastal areas where water from adjacent coastal ranges may percolate through the soil. Sections with similar ground-water supplies are found in some inland valleys. This accounts for the presence of abundant coconut groves in regions such as Paraguay. Open sunny country is an additional factor to good growth.

The author is an Agricultural Economist in the Office of Foreign Agricultural Relations. From 1941 to 1944 he served as a Vice Consul in the Office of the Agricultural Attaché in the American Embassy in Mexico City.

How They Grow

Seed nuts are the only means of propagating coconut palms. For this purpose care is exercised to select nuts from high-yielding parent trees. Usually the seed nuts begin to sprout after being in the nursery bed between 4 and 6 months. After this time they are transplanted to fields with careful attention to spacing. Trees in older plantings are generally poorly spaced and crowded.

Although this is not a general practice in the Americas, some growers plant intercrops during the early years of growth of the palms. Corn is one of the favorites, and, during the war, sesame was sometimes planted as a cash crop because of good financial returns. On some of the coconut plantations in the State of Colima in Mexico growers have set out lime trees.

Generally in well-cared-for plantations coconuts come into bearing in the seventh or eighth year. Those planted around villages sometimes take as long as 10 to 15 years before the first crop is produced. Coconut trees will continue to bear well until they are 50 to 60 years old, after which time the yield decreases. Although the tree is called a centenarian, most coconut palms die by the eightieth year. Since many of the coconuts in the Americas are found in wild state, yields per tree are low, probably averaging no more than 30 to 35 coconuts annually. On some of the well-kept plantations yields as high as 60 to 65 nuts are not uncommon.

When the old leaves of the palm fall off, a rough scar is left on the trunk. From counts made of these scars the approximate age of the tree can be ascertained. The coconut does not produce branches. Rather, there is only one growing point of the stem, at the center of the crown, and if this is damaged the tree dies.

Various diseases and insects have caused considerable damage to coconuts in the Americas. Probably the No. 1

Coconut nursery, showing three stages of development. In the right foreground are freshly planted nuts, to the left are sprouted nuts, and in the background, young palms ready for transplanting.

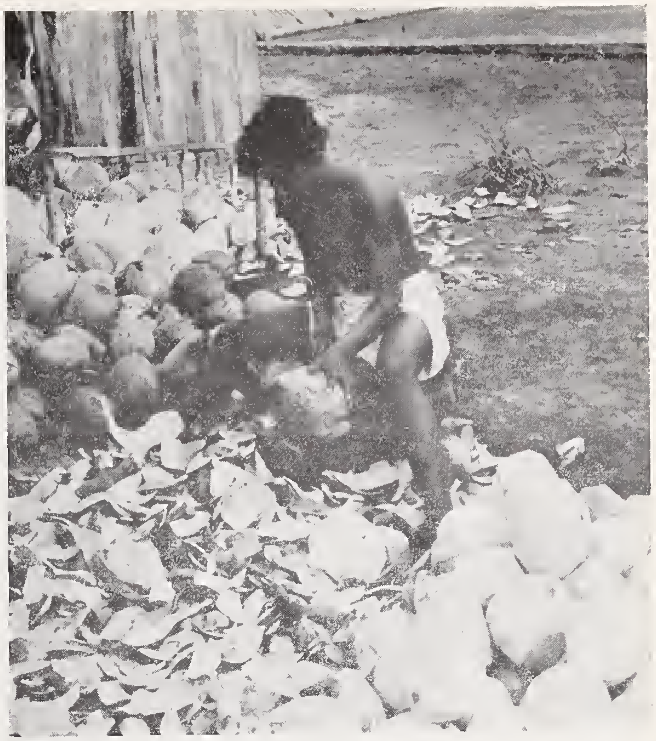
enemy has been bud rot, which was discovered in the Caribbean area before the turn of the century. In Cuba it has destroyed many coconut palms. Elsewhere in Central America and the West Indies serious destruction of groves has taken place. Scale insects and nematodes have exacted a toll in other areas. Work with insect predators and in other control measures has not advanced rapidly thus far.

Origin

Whether or not the coconut palm originated in the Americas is a question on which there is a divergence of opinion. The most commonly accepted thesis is that the coconut was a native of southeastern Asia or the vast archipelago lying off its coasts, and that the nuts were disseminated by ocean currents and floated from island to island, finally arriving on the shores of the Americas. Other evidence has been presented to the effect that the coconut originated in the Western Hemisphere. This school of thought contends that the coconut was distributed not by water but by primitive man in prehistoric times, and that coconuts were deliberately carried to other lands from the New World. The fact is further pointed out that 20 genera and 200 species of palms related to the coconut are natives of tropical America. The natural habitats of many of these palms are the interior valleys and plateaus far removed from the sea. The conclusion is that the coconut palm did not originate by the coast but in the drier, more temperate regions where the related palms have thrived.

That coconuts flourished in the Americas before the coming of the Europeans appears to be a generally accepted fact. Oviedo, a Spanish chronicler, writing in the early sixteenth century, makes definite comments about the coconut palm, as "a kind of date tree" bearing a fruit of "greater circumference than the head of a man." On the north coast of Cuba near Puerto Príncipe, Columbus reported the presence of coconut palms. Apparently the Spaniards were not familiar with the coconut palm at the time of their arrival because descriptions written by them invariably likened it to Old World trees.

Clean cultivation is important in a coconut plantation. (Note young palms planted in between the older ones.)



The heavy exterior of the nut is cut away with a machete.

Use in the Tropics

Although there are now probably between 750,000 and 1,000,000 acres of bearing coconut palms in tropical America, the use of coconuts on a commercial scale has never reached the importance there that it has in the producing areas of the Pacific and Far East. Most of the coconut trees in the Americas are found in wild state, the number of plantations being relatively few. As a ranking staple in the native dietary scheme, coconuts have assumed only a minor role. Even in the war years, as other commodities became scarce, there was only a moderate increase in consumption.

The chief use of fresh coconuts in most of the tropical coastal areas is for the coconut milk which is contained within the nut. Fresh coconuts are offered for sale in many of the local market places, and vendors will cut open the nut for drinking on the spot. In the growing areas, a few *centavos* given to one of the small *muchachos* will send him scurrying up the palm for a fresh nut. Despite the usual heat of the tropics, fresh coconut milk flows from the nut cool. Nuts are transported to the larger cities within the producing countries, largely for the milk, though the white meat just inside the shell is also eaten to some extent. These nuts are reasonably uniform in size and are shipped within a week to 10 days after harvest. In order to save space, a considerable portion of the fibrous husk is trimmed from the nut with a machete.

Dried and shredded coconut is used rather extensively in the preparation of candies. In Mexico a type of native sweet known as *alfajor* enjoys wide consumption. Similar confections are prepared in the other American producing countries.

Occasionally, dried or fresh cotyledons, the young seed leaves of germinating coconuts, are sold in local market places on the western coast of Mexico and Central America. The fresh cotyledon, when eaten raw, has a sweet delicate taste and is considered by some people to be more desirable than coconut meat.

In Mexico, near Acapulco, the Mexicans prepare a drink from the flower spathe. The local name of the drink is *tuba,* a word which was brought to Mexico from the Philippines several centuries ago by the earlier mariners engaged in trans-Pacific trade on the Manila galleons. To prepare this drink, the flower spathe is usually bruised for several days and then the end is cut. A sweet liquid exudes from the cut and is collected in various containers. Usually the *tuba* is consumed almost immediately, but occasionally it is allowed to ferment, and the resulting alcoholic beverage is termed palm wine.

The large leaves of the coconut palm are widely used for thatching, and the trunks are employed to a limited extent in construction. The inner portion of the trunk is too soft to be of much value, but the hard outer shell is sometimes used in cabinet making. When polished, the wood has striking markings, consisting of dark streaks and irregular lines on a reddish-brown background. The women use coconut shells to scoop out water from streams in washing clothes and in other household tasks. Intricately carved and polished coconut shells are offered tourists.

For copra production the nuts are split open and sometimes the meat is removed with a cup-shaped knife.

Copra from Coconuts

Copra is the dried meat of the coconut, having an oil content of about 66 percent. From this comes the coconut oil which in normal times constitutes at least 25 percent of the total world exports of fats and oils. Coconut oil is widely used for both industrial and edible purposes.

Before the war, the preparation of copra and coconut oil in the Western Hemisphere was of real significance only in Mexico, Jamaica, and Trinidad. Most of the American countries imported a large portion of their copra and coconut oil from the Far East. Only when Pacific supplies were cut off as a result of the war did the American republics begin to produce more domestic copra. Now copra production in this hemisphere averages about 70,000 to 75,000 short tons yearly.

In comparison with the large quantities of this commodity produced in the Pacific area, the total American production is insignificant. It also seems to be of little consequence in the total fat and oil situation when compared with the greatly increased production of other oilseeds, such as sesame, sunflower, and flaxseed. Yet the larger output of the last 4 years has been substantial enough to be of aid to domestic manufacturers, especially in providing an oil of high lauric-acid content. The increase has come about less through the efforts of the various governments to foster production than by the stimulation given the industry by favorable prices and rising demand created by the loss of former sources of supply.

Countries Producing Copra

Most of the copra in the Western Hemisphere is produced in Mexico, Central America, the Caribbean Islands, and along the northern coast of South America. Mexico is the largest producer, with a production which may reach 40,000 tons in 1945, more than double that of prewar years. Guerrero and Colima on the Pacific coast and Campeche, Tabasco, and the Territory of Quintana Roo on the eastern seaboard are the leading producing areas. In addition to being the largest American producer, Mexico imported on an average 46,000 tons of copra before the war and imports were increasing rapidly.

The British West Indies rank second in copra production. The two islands of Trinidad and Tobago have had an annual average output in recent years of 11,000 to 12,000 tons. Although better known as a shipper of fresh coconuts, Jamaica had an annual production of about 9,000 to 10,000 tons of copra until 1944. In that year a tropical hurricane seriously damaged the coconut groves, destroying, some reports indicate, 40 percent of the trees. In Trinidad and Tobago a drought in 1940 and 1941 caused some lowering of production, and since that time shortages of labor have somewhat hindered production.

Panama produced about 2,500 tons of copra in 1944. The construction, in 1938, of a vegetable-oil plant helped

(Continued on page 215)

A typical river basin in the southern Andes, where terracing is practiced on the steep mountainsides.

Insect Problems of Peru's Sierra

Problems usually increase as new territories are opened up. What to do about the insect pests of its Sierra region is one of Peru's major problems.

by PAUL KNIGHT

More than 60 percent of Peru is in the Sierra, the high and generally treeless mountains of the Cordillera, and here 70 percent of the population live. The agriculture of these mountains consists largely of grazing and of intensive cultivation in narrow serpentine valleys and scattered fertile mountain slopes. Here and there desultory cultivation is found on comparatively level areas high in the Andes where some grain grows at 13,000 feet and potatoes at 14,000. Much of the land is too high or too steep and rocky for farming.

The following entomological observations are based on the author's experience in three of these mountain areas where food production is now being stimulated, two of them east of the Continental Divide. In the coastal oases most of the major pests were familiar, but in Peru's Sierra region new crops, such as the coca plant, from which cocaine is derived, and the quinoa, the edible pigweed of the high Andes, were unfamiliar and presented new pest problems.

The isolation of areas of agricultural production is a matter of great importance. Not only is the Sierra a barrier between the Amazonian lowlands and the coastal desert, but mountains isolate valleys from each other just as desert isolates one coastal oasis from another. Thus we have iso-

lation within each of the major regions as well as between them. The new highway from Lima through Cerro de Pasco, Huanuco, and Tingo María to Pucallpa, a city on the navigable Amazon, will slowly remove some of this isolation. Expanding local airways will do it rapidly. The Inter-American Highway, which follows the coast from Ecuador to Chile, has already brought more closely together the desert-separated valleys along the coast.

From an entomological point of view this isolation of regions of production is a significant factor. There no doubt exist in Peru insects indigenous to limited areas which have the potential ability to expand and might be said to be awaiting transportation to regions where the environment might prove more favorable. It is a well-established fact that, except for strong-flying insects, such as the migratory types of locusts and certain species of migratory butterflies, the dispersal of pests across the face of the globe has been accomplished largely through commerce. Most species lack the ability to transcend great barriers such as oceans, deserts, or mountains.

Courtesy of Grace Line

Plowing on the Santa Ana plain near Cuzco, Peru.

Entomological Problems

Although the most extended research in Peru has been carried on in connection with the cotton and sugarcane pests of the coastal haciendas, significant contributions have been made toward an understanding and control of the insects which attack potatoes, small grains, fruits, and minor crops of the Sierra. Some of this research has been sponsored by private growers' associations, but for about 15 years the government *Estación Experimental Agrícola de la Molina* has maintained a continuous experimental and training program. A number of young Peruvian entomologists have gone into the field from this institution.

The *Ministerio de Agricultura* of Peru is now developing an extensive field service reaching into every important agricultural section of the nation, in which these young technicians are taking their places. This *Servicio Cooperativo Inter-Americano de Producción de Alimentos* (SCIPA), a joint project of the Governments of Peru and the United States, has on its staff three entomologists who are graduates of La Molina, located in field stations at Cuzco, Huacho, and Piura. As young entomologists are established in the rural areas of Peru, more attention can be given to the insects attacking food crops and livestock.

In 1943 Dr. Johannes Wille, Entomologist of the La Molina Experiment Station, published the first comprehensive book on the insect pests of Peru, entitled *Entomología Agrícola del Peru,* a publication which brings together for the first time a broad summary of the economic entomology of the country. It is significant that about 40 percent of the entire book is devoted to the pests of the large hacienda crops, particularly cotton and sugarcane, which grow in the coastal regions. But the lack of information on certain types of pests is even more significant in that attention is called to the problems which need serious research. The importance of Dr. Wille's efforts is not easily appreciated by entomologists who have seen the book but not the country in and about which it was written. Economic entomology is relatively new in Peru and is ready for expansion.

One of the difficult insect problems to solve in the Sierra regions where cultivation exists is the *langosta,* or migratory locust, especially the widely distributed *Schistocerca paranensis.* This species is the major locust pest in many localities from southern Mexico to northern Argentina. Although of sporadic occurrence, it often sweeps all plant life before it, causing acute suffering in areas where agriculture is difficult enough without a locust invasion.

The migratory locust problem is not one that can be dealt with easily, and in fact it cannot be dealt with adequately by a single country. Migrations ignore barriers that would be impassable to most pests, resulting in mass movements of these insects for hundreds of miles from their breeding grounds. The breeding range of the migratory locust is often restricted, but the area in which it can cause severe damage is usually as far as it can fly. International boundaries mean nothing. The favorable breeding grounds may be in Peru, but Ecuador or Chile may also reap a portion of the harvest of adults.

The only permanent solution is organization on hemispherical proportions in order to locate and chart the major areas of breeding and the paths of migration. Control can be effective only if applied to the insect before mass flights commence; after that there is little to do but watch the wholesale destruction. Such a control plan has already brought results in Africa, where the work of the International Locust Commission has made considerable progress. This organization and the campaign waged successfully for many years in western United States by the Bureau of Entomology and Plant Quarantine are well known to many agriculturists in South America. There is good reason to believe that an inter-American organization to attack the locust problem would have an enthusiastic reception.

From northern to southern Peru there are many impor-

Mr. Knight, who had been Assistant Professor of Entomology at the University of Maryland for many years, worked as entomologist in Haiti, making a survey of the insect pests of the *Cryptostegia grandiflora* plant, and with food missions in Peru.

tant centers of potato production, some of them in the regions of the ancient Inca terraces on mountainsides with a 60° slope. Such centers are found as high as 14,000 feet above sea level. The control of pests which infest these potato areas forms a serious problem of the Sierra.

The potato tuberworm (*Gnorimoschema operculella*), familiar enough to many North American potato farmers, occurs generally throughout the Andes, where it is the most destructive species attacking the tuber. This insect, together with several species of weevils, of which *Premnotrypes solani* is the most important, are known as *barrenadores de las papas,* or potato borers. When potatoes are shipped from the cool mountains to the warm coastal regions, where most of them find their market, damage from the tuberworm becomes aggravated. The worm first attacks the potato in the field, but its damage is carried over into the storage house, where it breeds without interruption. Within 8 or 10 weeks after going into storage in the lowlands the tubers are practically worthless.

At the present time a large storage house is being completed at Oroya, at an altitude of 12,000 ft., where planters may store large quantities of potatoes under government supervision and release them to the markets slowly rather than attempting to move large quantities to Lima and other lowland areas. This will naturally aid greatly in reducing the destruction from the *barrenadores,* especially if infested tubers are not accepted for storage. Upland storage is preferable to lowland because of the slower rate of development of the tuberworm at high altitudes, and even in the crudest types of buildings at high altitudes injury is far less than in better structures near sea level. Added to better storage facilities, clean culture and a program of seed selection and certification similar to that which reduced the ravages of the tuberworm in the eastern potato belt of the United States will do much to reduce the damage in Peru.

There is, however, a scarcity of data concerning the life histories and habits of these high-altitude potato pests, and much research under Andean conditions is needed. The idea is prevalent among the potato growers that once a potato farm has become infested with *barrenadores* the only control is to stop planting potatoes for 7 years, after which time the fields will again be free. This is not a superstition; several highly trained agriculturists in Peru state that it is the one control that actually works. This does not mean that more practical control measures involving less waste of land may not be developed when more is known about these tuber pests, but at present vacating the land is the widely practiced method of extermination.

Increasing Diversity Brings New Problems

Cotton, sugarcane, and potatoes are the large-scale crops of Peru. An enormous variety of other crops are grown on a smaller scale, and there is a trend toward diversification of crops for food. As the production of beans, tropical fruits, green vegetables, grapes, and numerous other crops expands, a multiplicity of insect problems will develop.

The coca plant, which grows on the eastern slopes of the Andes, is attacked by several destructive insect pests. A worker is shown stripping off the leaves which will be used later for making cocaine.

As transportation and communication expand in Peru, there may be numerous examples of pests once locked within the limits of a single valley in the Andes being inadvertently transported quickly across high passes they could not negotiate alone, resulting in the establishment of unfamiliar species of pests in new areas of production. Such invasions may remain unnoticed for a long time. While many insects from the coastal regions will not be able to survive in the high mountains, and vice versa, one cannot be sure which species will and which will not be able to thrive in unfamiliar surroundings. In the case of a crop which grows in both the altiplano and the coast, as is true of alfalfa, some grains, and several types of beans, there is no assurance that a pest from one region will not be able to establish itself in the other.

The owner of the large hacienda is in a better position to handle the problems of insect control than is the small operator. The owner of a small tract often finds it cheaper under present conditions to accept inevitable losses than to invest in materials and equipment that may not be justified by his income. The Government of Peru, realizing the situation, is expanding its field agricultural service to all parts of the nation, including the small landowner. Only thus can the increasing problems of pest control be met.

Tropical Kudzu

Kudzubean, which is popular in the southern part of the United States, does not do well in Puerto Rico. Tropical kudzu, however, a close relative, is proving highly satisfactory on that island and is meeting a real need.

by **EMERY A. TELFORD**
and **NORMAN F. CHILDERS**

A definite need has been felt in Puerto Rico for a vigorous legume which would cover the ground thoroughly and quickly from seed, thus helping to control hillside and gully erosion and at the same time adding organic matter and nitrogen to the soil. Tropical kudzu, *Pueraria phaseoloides* (javanica) Benth., fills this need. The climate and soils of Puerto Rico appear to be well suited to the growing of Tropical kudzu, whereas various experiments in raising the ordinary kind of kudzu on that island have not proved successful.

This perennial legume has several other qualities: It is relatively resistant to drought; grows well in full sun and beneath trees of moderate shade; has no serious insects or diseases; makes good pasture for dairy cows in Puerto Rico; and produces abundant seed, from which it is easily established. The legume tends to spread from an original planting when seeding is permitted, but it can be destroyed easily by plowing. It does not at this time show signs of becoming a pest on cultivated lands.

Tropical kudzu is a common crop in Java, Sumatra, Malay, and neighboring countries, where it is used as a ground cover while young rubber and cinchona plantations are becoming established. The Firestone Plantations Company, in Liberia, West Africa, reports several thousand acres of this cover crop in their young rubber plantations. In the *Indio-Rubber Journal* of April 6, 1940, the report is given of a reduction in root rot of rubber trees where this plant was used in Sumatra as a cover crop.

The crop has been grown only since 1940 in Puerto Rico but has already proved itself superior to other legumes and many grasses at the Federal Experiment Station. Its trailing runners may extend from 10 to 15 feet up and down banks, under trees, and over grasses and weeds until most undergrowth is smothered. It competes successfully with such grasses as nut (*Cyperus rotundus* L.), carpet (*Axonopus compressus* (Swartz), Beauv.), Guinea (*Panicum maximum* Jacq.), molasses (*Melinis minutiflora* Beauv.), and *malojillo* (*Panicum purpurascens* Raddi). When planted among young trees, it has a tendency to climb the trunks, but the runners can be removed at 2- or 3-month intervals, and the labor involved is much less than that required to cut with a machete the natural growth of the entire area.

Not Exacting in Soils

Tropical kudzu is not particularly exacting in soil requirements. At the Station it is growing and flowering luxuriantly on heavy excavated clay soil. Some roots were found penetrating to at least 4½ feet. No doubt this accounts for its ability to continue growing slowly during extended dry periods when other legumes, such as trailing indigo (*Indigofera endecaphylla* Jacq.), show considerable distress. The fact that it is a legume eliminates the need for applications of commercial nitrogen. The seed must receive inoculation, however, in order that bacterial nodules may form on the roots. Otherwise, the plant may grow weakly and show nitrogen-deficiency symptoms. Seeds have been successfully inoculated by mixing with powdered soil from an area where the crop had formed root nodules.

Cultivation Is Easy

In Puerto Rico the crop seeds heavily in December, January, and February, producing about 150 pounds per acre on soils of average productivity. The seed pods are harvested by hand and placed on canvas in the sun, where the pods break open upon drying. The seeds are about one-sixteenth of an inch in diameter. Treating the seed for 30 minutes in a 1:1 water-commercial sulfuric-acid solution is advisable, to obtain 90 percent or better germination. The seeds seem to germinate better if they are held for 6 months at ordinary temperature and humidity. In Puerto Rico the seeds have suffered practically no insect damage and show satisfactory germination after a 3-year storage period.

Seeds are planted at the beginning of or during the rainy season at a rate of 3 to 5 pounds per acre, depending upon the purpose of the crop. If one purpose is to control erosion on steep more-or-less-barren slopes, the seeds are

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sown in rows 3 feet apart around the slope. About 15 seeds are sown per linear foot in 2- to 3-inch plow furrows and they are not covered with soil, as sufficient silt will wash into the furrows to cover the seeds during the rainy season. If the ground has little or no slope and the crop is to be used as a cover among trees such as rubber, circular patches of ground 3 feet in diameter can be prepared about 15 to 20 feet apart on the square and the seeds broadcast. If rains are irregular, the seeds may be scratched in with a rake and covered with about an eighth of an inch of soil. A quick ground coverage for pastures can be secured by preparing small patches of ground about 3 feet apart and dropping a pinch of seed on each "hill." Heavier forage and seed production can be obtained per acre if tripods of bamboo poles or other wood are arranged at intervals for the vines to eventually cover.

With regular rains, the kudzu should thoroughly cover the ground in 5 to 6 months and become deeply rooted by the beginning of the dry season.

Serves Many Purposes In Puerto Rico

Tropical kudzu forms a dense mat of runners and dead leaves over the ground, climbing over and almost smothering such plants as *yautia* (Xanthosoma spp.). Tropical kudzu and *malojillo* grass growing together, however, have both made good progress on the grounds of the Insular Agricultural Experiment Station at Río Piedras. This combination appears to be desirable for grazing from the standpoint of palatability and nutrient value. On the basis of chemical analyses Tropical kudzu compares favorably with other legumes and has about three times as much crude protein (15.17 percent dry basis) as do such plants as Guatemala grass (*Tripsacum laxum* Nash) and Guinea grass.

During the rainy season cows readily graze the tender foliage of Tropical kudzu, but during the dry season, when growth is slow and the foliage may be somewhat dusty and tough, a day or two are required before the cows become accustomed to it.

No Known Commercial Source of Seed

There is no known commercial source of Tropical kudzu seed in the Western Hemisphere at this time. Over 150 pounds of seed were collected this year from the experimental plantings at Mayaguez and Río Piedras, but this seed will be used largely for increasing plantings in Puerto Rico. Inasmuch as the plant grows rapidly and seeds heavily, however, seeds for experimentation should be available within a comparatively short time.

Tropical kudzu was the best source of green forage for the Puerto Rican Experiment Station during the extended dry period of 1945.

Courtesy of U. S. National Museum

Early terrace or "staircase" farming along the Urubamba River.

Agricultural Designs In Early Peruvian Pottery

Archeological remains in Peru reflect a high standard of agricultural development in that country centuries ago.

by **JANE W. ROLLER**

All great New World civilizations have stemmed from economies based on an agriculture which has been thousands of years in the making. When Asiatic tribes migrated onto this continent during the Ice Age, or at the close of it, they led a nomadic existence. These people gradually spread into all sections of the hemisphere and became the aborigines of the Americas.

Certain tribes in the Peruvian area, after centuries of wandering, began cultivating the wild plants of the fertile valleys. Some archeologists believe that American agriculture may have had its origin in Peru, beginning when the first nomad prodded a hole into the ground to plant a root. This started a whole chain of unique events which culminated in the production of the many economic plants of the Americas which are known everywhere today. A program of plant cultivation and selection, which took centuries, even milleniums, to achieve and untold patience and farsightedness on the part of those engaged in the work, grew out of this. It involved the principles of plant breeding and a myriad of other complex biological problems. Through successive generations these Indians slowly developed the fruits, grains, and vegetables upon which their life depended. The Peruvians used these in their art.

Pre-Incan Agriculture

Favored by an invigorating climate, fertile soils, and a heritage of diversified edible plants, pre-Incan culture flowered into the highest type of agricultural development

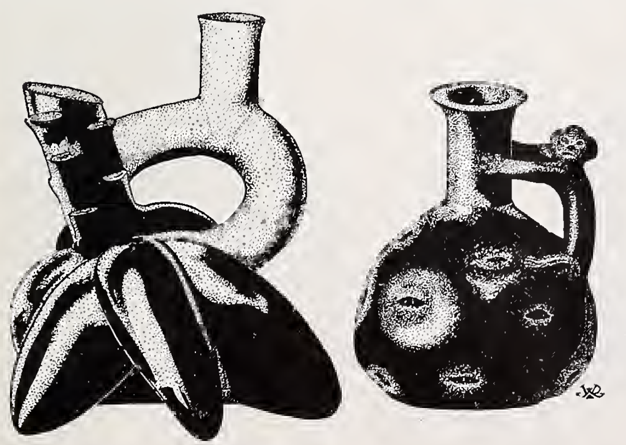
known up to that time. A type of agriculture was practiced by these Indians almost 2,000 years ago which has only recently been recognized and put into use in the United States. This practice was to build up and restore soil fertility, rather than "mine" the good earth through poor land-usage methods. Today a similar land-restoration program in the United States is producing superior crops, sturdier dairy and beef cattle, and healthier citizens.

The pre-Columbian Indians irrigated the flat fertile coastal areas through aqueducts and ditches which diverted the mountain streams into the desert. Highland tribes in Peru actually rebuilt the steep Andean slopes, moving tons of rock and soil to build terraces or "staircase farms," where they cultivated a wide variety of fruits and vegetables. The terraces were made by filling soil in behind rock retaining walls which followed the contour lines of the mountain. Stones were laid at the bottom for drainage, clay on top of these, and a few feet of rich topsoil.

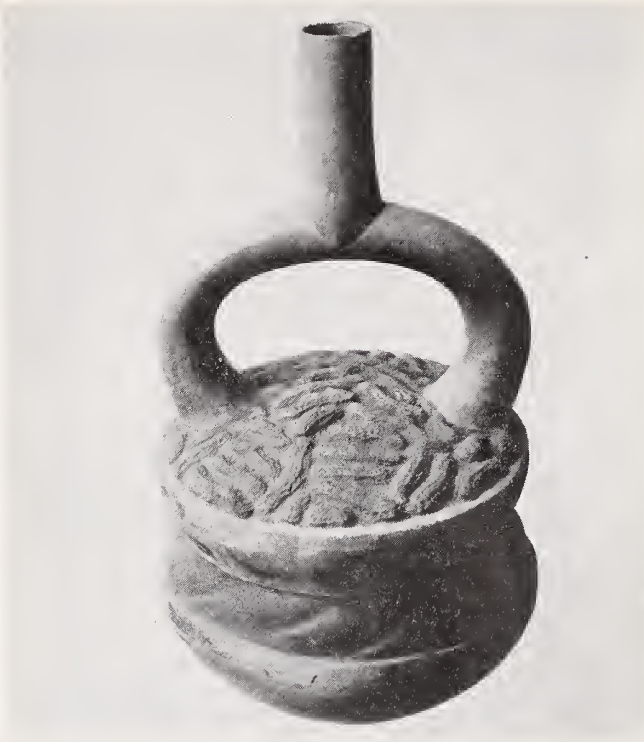
Archeology, Key to Early Civilizations

Archeological timetables place the beginnings of these early civilizations far in advance of the coming of Christ. Mochican culture was at its height along the north Peruvian coast during the first 600 years of the Christian Era. Later this culture was succeeded by a civilization of Tiahuanaco origin. Around A.D. 1300 a civilization known as the Chimu rose into power and controlled the fertile lands held by the earlier peoples. About a century before the Spanish Conquest, in the early 1530's, the Inca Empire to the south encroached on the Chimus and spread through the area.

The area occupied by these early Peruvian tribes extended from the Chicama Valley south to the Santa Valley, between modern-day Chiclayo and Chimbote. Stretching from 150 to 200 miles over desert terrain, this ancient region is crossed at 30- or 40-mile intervals by 5 or 6 short rivers which rush seaward from the high Andes. The pre-Columbian Indians constructed intricate aqueduct and irrigation-ditch systems and cultivated almost every inch of the fertile shallow valleys. Some of these aqueducts still



On the left is a cassava, or manioc, vase from Mochican excavations. On the right is a Chimu potato vase from Chimbote.



Courtesy of U. S. National Museum

Mochican peanut roaster.

exist although many were destroyed by the Spanish, covered by landslides, or ruined by the torrential downpours which occur about once in every 35 years. Crops were cultivated on the same site year after year by the Indians, who replenished soil fertility with fish and guano.

Archeological findings in the graves are one of the best sources from which to obtain information about these early cultures. The typical Mochica grave is a rectangular vault 3 to 10 feet underground. Lined with adobe brick, the same material as that used for the houses, these graves were always placed on the slopes and away from the farm lands. They contain pottery and the desiccated plant and animal remains placed there as food for the deceased. From this excavated material, archeologists surmise that the early agriculturists devoted their leisure time to the development of the primitive arts—pottery making, weaving, and metallurgy. The pottery, through shapes and designs, shows clearly the agricultural interests of the people.

Mochica Plastic Art

Pottery of the Mochican Era possesses a charm and realism that are expressive of the artistry of this period. The wide variety of fruits and vegetables used as motifs for the pottery indicate the extent to which agriculture had been developed. Scientists believe that centuries of plant breed-

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ing are involved in the plant forms which are held for posterity in the Mochican potter's clay. Each jug and bottle is so accurately designed that the fruit or vegetable is clearly recognizable.

Little change has occurred in the appearance of these vegetables after 1,500 years of domestication. Several of the same plants which were cherished and cultivated in those days of dim antiquity stand first in the economies of some countries even today. Man has perfected few new plants of economic importance since the potato, corn, squash, sweetpotato, peppers, and various types of beans were domesticated by the ancients and generously portrayed by their potters.

Some of the most familiar designs centered around corn. In the Americas the golden kernels of corn, the largest of all grains, formed the basis of all the great pre-Columbian civilizations except those in the high altitudes. There quinoa (*Chenopodium quinoa* Willd.), close relative of lamb's quarters (a common garden weed) was the staple crop. Corn was held sacred by the ancient Peruvians, figuring largely in their rituals, folklore, and artwork. Ears of corn appeared frequently on ceremonial vessels together with images of the corn god. Other jars were formed like maize baskets and the ears were modeled so accurately that it is hard to believe they are not fossilized. In fact, for a time the clay replicas of some ears of maize found in ancient graves were thought to be fossils, until they were examined more carefully. Modeled ears of several varieties of corn also have been found. Some of these varieties are still grown today. Often a plain pot was decorated with paintings—a picture of a maize field in tassel, long slender peppers, or a border of conventional pepper designs.

Models of the potato, accurate even to the spiral arrangement of the eyes around the tuber, and of the squash, in the form of jugs, have been excavated. The squash vessel was probably molded in clay from the real fruit, a band of nubbles being added for decoration, and the model fired to make it flint hard. A two-piece mold was prepared from this model, and the jug was cast in clay. With base and spout added, a final baking produced the finished vessel. Sweetpotato, canna, and manioc (cassava) are some of the root crops used by the Indians as motifs for various types of containers.

Mochican pottery was usually made of reddish clay. A white or cream-colored slip or ground coat of opaque pigment covered all or part of the vessel. On this background abstract designs of small vegetables were painted with earth pigments—terra cotta, brown, and black. Occasionally other colors were used, but more emphasis was placed on form than on color. A small percentage of this pottery, known as blackware, was modeled in a very dark clay and was not painted. Most Mochican work, however, was in the terra cotta shades.

A vessel in the form of a head, the portrait jar, was a favorite type of the Mochican potter. The surface of the face was skillfully finished in a lifelike manner by burnishing the untinted natural clay with a smooth pebble or shell. The decorations of the headdress were painted on top of the ground coat.

Double-bodied vessels of various shapes and forms were typical examples of Mochican pottery and also featured in the later Chimu period. The peanut roaster, with accurately modeled unshelled nuts decorating the top, is a representative of this style.

Perhaps the most outstanding achievement in pottery designing was the invention of the closed vessel with a stirrup spout which also served as a handle. Especially adapted to a desert climate, where water is precious and evaporation is high, this ingenious Mochican spout was used on a variety of portrait vessels and water bottles. It facilitated the pouring of water through a narrow opening. Air entering one arm of the hollow stirrup, to which the

Courtesy of U. S. National Museum

Left to right: Squash, sweetpotato, and corn vases, from the collection in the U. S. National Museum.

spout is attached, increased the flow of water through the other arm.

Other pieces of pottery represent tropical fruits. On exhibit at the United States National Museum in Washington are two blackware vessels in the shape of the cherimoya. They are without bases and spouts, but are so perfect in form that they must have been cast directly from the original fruit. The cherimoya is a rough, succulent fruit about the size of a grapefruit, belonging to the same family as the papaw or custard apple of North America. The pepino, a striped melon-like fruit of the potato family, and the lucuma, relative of the sapote, are examples of fruits commonly used as models by the Indian potters. Specimens of the shriveled pulp and glossy seeds of the lucuma have frequently been found in Indian graves together with various types of pots.

Tiahuanaco Indian Pottery

Excavational work reveals that archeological remains changed in the fertile coastal valleys of Peru around A.D. 1000, when the Tiahuanacos came into the valleys. Painted vessels, typical of the Tiahuanaco civilization of the Bolivian Andes and Lake Titicaca, were now found in abundance. The plastic forms of the Mochican culture and the agricultural motif disappeared altogether.

This does not indicate that agriculture ceased or that it even diminished. Evidence points to expanding populations, and food production probably increased to meet that expansion. There is no artistic record of agriculture, for these middle-period people had art traditions totally different from those of the coastal people.

The pottery of this period found in the mounds is generally well finished and decorated in five or six colors as in the Tiahuanaco highland pottery. The vessels are of various shapes, but usually have flared sides instead of being closed as in the earlier coastal pottery. The kero-shaped goblet and flat-bottomed shallow open bowl are shapes which did not occur in the highlands, but were developed on the coast. Condor and puma designs, grotesque heads, and humanized mythical creatures feature in this pottery. Bowls were decorated with the step motif, four-footed unidentified animals, birds' heads, and other conventional or abstract geometrical designs.

After flourishing for about 300 years, this civilization apparently declined, and the area was taken over by the Chimu Indians around A.D. 1300.

Chimu Pottery

Under the Chimus, plastic art reappeared. Again pots and vessels were modeled from the fruits and vegetables used by the Indians. North of the Chicama Valley, this plastic tradition in pottery probably continued unbroken from Mochica to Chimu times, the peoples drifting southward after the decadence of the Tiahuanaco civilization to a more favorable locality.

Technically Chimu work is as good as Mochican, but artistically it is considered inferior. Blackware constitutes a large proportion of this pottery, and the stirrup spout is not always present. Representations of animals are sometimes found in Chimu pottery. The llama, guinea pig, and fish are important animal motifs.

The double-bodied whistling jar, a clever invention of the Mochican potter, was used to a greater extent by the Chimus. In principle, the construction is much the same as the stirrup spout, though more elaborate. Unlike the modern whistling kettle, which operates on an escaping-water-vapor principle as the water begins to boil, a whistle is produced as air replaces the cold water poured from the vessel. The clay animal perched astride one side of the stirrup whistles when air rushes through a series of passageways in its body as a replacement for the water poured from the vessel.

In their art the ancient Peruvian Indians have left a record of the wide variety of fruits, vegetables, and animals which formed the basis of their living. These agricultural products were the models for their plastic pottery and indicate the high degree to which agriculture was developed as far back as pre-Columbian times.

COCONUTS

(*Continued from page 206*)

to bring about a greater domestic demand, and in 1941 a few dryers were set up to permit drying of copra during the rainy season. During the early years of this century a number of coconut plantations had been established. Many of these were subsequently abandoned, but interest in them has revived during the past 3 years. The main centers of production are the Gulf of Montijo on the Pacific coast and Bocas del Toro and San Blas on the Caribbean side. The quality of the coconuts from the San Blas Islands particularly is regarded as excellent.

The picturesque Bay Islands off the coast of Honduras are a center of production, and a small number of coconuts are grown in the region adjacent to La Ceiba. The Honduran industry has expanded greatly as a result of war. Prices have been favorable, and Honduras has shipped copra to neighboring countries and to Mexico. Some artificial drying is done during the rainy season, but most of the copra is sun dried.

Much of the Nicaraguan copra production, which has shown considerable increase since 1941, comes from the Corn Islands. On the mainland, too, coconuts grow along the entire 360-mile Caribbean coast. The bulk of the coconut oil is used in the local soap industries in Granada, Managua, and León, and the rest is used for cooking oil and in the manufacture of vegetable compounds.

A number of South American countries are producing coconuts. In Ecuador the coconut States are Manabi and Esmeraldas. Some expansion in production has taken place

in Colombia during the war years, but much of the coconut lands still remain unexploited. The largest portion of the product comes from the San Andrés Islands, and most of the copra is processed near Barranquilla. In Brazil the number of coconu trees is variously estimated at from 5 to 6 million. Few of the coconuts, however, are dried for copra. Instead, practically all are consumed for milk and meat. Brazil has concentrated more on the production of other palm-kernel oils such as babassú and uricury.

In the postwar period, the emphasis on domestic copra production may decrease in many countries of the Americas. Unlike the Pacific Islands and Asia, where copra production is the primary means of economic livelihood for many people, in the Western Hemisphere there will probably be increased competition for labor in other crops and industries. Other palm-kernel oils, such as babassú, uricury, and cohune, may be easier and more desirable to exploit. Importation of cheaper copra and coconut oil from the Far East when trade is resumed may prove more feasible.

Fresh Coconuts For the United States

Probably more than 60 percent of the fresh coconuts brought into the United States have been for conversion into shredded coconut, which is a favorite ingredient for cake icings and for candy. The main centers for the shredding industry are New York and San Francisco. The total amount now processed from imported nuts is negligible compared to the vast amounts of shredded coconut imported from Ceylon and the Philippines before the war, but the quality is reported higher.

Tropical America has held top position as a supplier of whole fresh coconuts to the United States. During the 5-year period, 1935-39, the average number of coconuts imported from the other Americas by the United States annually totaled 42 million. During those 5 years, however, imports of coconuts showed a marked downward trend. Fifty-six million were imported in 1935, only 28 million in 1939. Imports continued to decline through 1942, when only 16 million coconuts arrived in the United States. In 1943, however, when shipping facilities became more available, imports rose to 43 million.

Jamaica supplied the greatest number, followed by Honduras and other Central American republics. During the past 2 years shipments from Mexico have been increasing. Puerto Rico has averaged better than 11 million coconuts.

Because of the loss of Eastern supplies, greater emphasis has been placed on the processing of fresh coconuts from the other Americas. Puerto Rico has developed the most significant shredded-coconut industry. Cuba and Mexico have established similar industries on a smaller scale. At the same time the production of copra for coconut oil has increased. Coconuts are thus furnishing a sizable industry for tropical America.

RIVER BASIN

(*Continued from back cover*)

branches of the Aztec Empire had colonized the lower slopes and mountainsides surrounding the valleys cut by the main stream of the river. Spanish culture and tradition were superimposed on those of the Indian, and in the cities this intermingling produced a new society embracing features of both its ancestors. In the rural districts, however, even today Indian tradition and habits of life predominate, with corn the basis of agriculture and the principal article in the daily diet. The rural populations are still concentrated on the lower slopes of the valleys.

Cities are prominent in this area too, Guadalajara being the second-largest city in the Republic. Toluca, Aguascalientes, Zacatecas, León, Celaya, and Guanajuato are all important centers. Many of them were built around silver and gold mines that contributed to the riches of Old Spain as well as to the development of modern Mexico. Deposits of copper, lead, zinc, antimony, mercury, iron, and coal add to the resources of the basin. Mining has declined in El Oro, Guanajuato, and Aguascalientes but is still a major activity of the region. The cities here also play a part in the rapidly expanding industrial development of Mexico. Settlement is much less dense in the lower reaches of the Santiago than in the Central Plateau portion. Life centers around the river, although the stream is subject to sudden floods, spreading 25 miles in some places during the rainy season.

Forests cover much of the Sierra Madre Occidental, a large part of which drains toward the Lerma-Santiago. Both building and cabinet woods abound, the most important being oak, pine, cedar, ash, and mahogany. In the warm dry zones valuable forest products include candelilla wax and guayule rubber. In the moist lowlands vanilla is important.

Its Transportation

Since Colonial days, the river itself has served as a means of transportation by small boats. Cortez and his followers sailed down it to the sea in barks, as did the Indians before him. It is not navigable for larger vessels, however, except near the mouth of the Santiago.

Located in the great Central Plateau, the basins traversed by the Lerma-Santiago are the centers of other transportation systems too. The Old Spanish Road across Mexico swept from the Atlantic port of Veracruz in a broad highway to Guadalajara, where it forked to go south to Acapulco and north to San Blas. A modern highway now connects Guadalajara with the Capital City, and railways fan out from the Basin of Guanajuato across northern Mexico to the United States border at Laredo and El Paso, Texas, and Nogales, Arizona.

(*Continued on page* 217)

ALONG THE *Agricultural Front*

▲ Dr. Rowe Marks 25 Years As Pan American Director

Dr. Leo Stanton Rowe, able Director of the Pan American Union, is this year celebrating the twenty-fifth anniversary of his appointment as head of that organization. Even before his appointment as Director of the Union, Dr. Rowe had taken an active part in Latin American affairs. He was appointed a member of the McKinley Commission that codified the laws of Puerto Rico in 1900-01, and in 1919 he was chief of the Latin American Section of the Department of State.

▲ Argentina Studies Control of Green Bug

Because of the serious damage done by the green cereal aphis (*Toxoptera graminum* Rond.), also known as the green bug (*pulgón verde*), the Argentine Ministry of Agriculture has disclosed the results of the work done by the Institute of Plant Sanitation in finding the best methods of controlling the pest.

This insect first became a pest in Argentina in 1937, in the Provinces of Entre Ríos and Santa Fe, and has spread to all the grain and forage regions of the Republic, especially in dry years and cold seasons, with oats, barley, wheat, and rye as its preferred hosts.

The Institute has been studying the possibility of controlling the green bug by means of its natural enemies, of which two are known: The braconid wasps *Aphidius platensis* and *Diaeretus plesioraoae*. The second of these is found in nearly every region infested by the green bug. These parasites multiply rapidly at temperatures above 23° C. (73° F.), but their life cycle is lengthened and their usefulness reduced at temperatures below 18° C. (65° F.). The Institute is studying the possibility of raising other parasites and predators more resistant to low temperatures.

Emergency measures recommended by the Institute are: Planting forage crops early and grain crops late, to avoid the peak of the infestation; avoidance of planting only a single species like oats or barley; inclusion of common rye among the feed crops; and sending specimens of the green bug immediately to the Institute of Plant Sanitation to learn whether the pest is parasitized or not. If not, the Institute will send colonies of the natural enemies to interested persons.

▲ Naranjillas Growing in Guatemala

An experiment in the growing of naranjillas in Guatemala, at the *Instituto Agropecuario Nacional,* formerly known as the *Instituto Químico-Agrícola Nacional,* has been reported as proving successful. The first crop of the fruit has been harvested and is said to be exceptionally fine. A second sowing may now be made with seed cultivated in Guatemala.

The naranjilla (*Solanum quitense*) is a fruit, resembling in its various properties both the tomato and the orange. Up to this time it has been grown almost exclusively in Ecuador. (June 1944 *Agriculture in the Americas.*)

The juice of the naranjilla has been popular in Ecuador as a drink and has been used for making marmalade and pies. Though it is a pleasing drink, rich in vitamins, there has been almost no exportation of the juice because no process of pasteurization or concentration by evaporation had been found satisfactory enough to warrant commercial exportation.

Now expanded preparation of a highly concentrated naranjilla juice that will be full-flavored and stable is contemplated in Guatemala by a freezing process. It is much the same process as that by which 6 or 8 years ago samples of the naranjilla juice were prepared in Quito and attracted some interest in North America. The juice is frozen and the ice which is formed, consisting of pure water, may be separated either by centrifugation or filtration. When the concentrate which is left, perhaps one-tenth in volume of the original juice, is passed through a bacteria filter, it becomes sterile. Such a product would be suitable for exportation.

RIVER BASIN

(*Continued from page* 216)

Its Agriculture

Most of the area of this basin lies in the agricultural region of the Central Plateau, where the climate resembles that of the Temperate Zone, and where rainfall is more abundant than in northern Mexico. In the western part of the basin, the river itself provides water for irrigation.

At least a third of the country's two staple foods, corn and beans, come from this region. These two crops grow on large and small farms throughout the course of the river from Toluca to Guadalajara and are vital in the food supply of the people there. The region is also an important producer of wheat and barley, chili, broad beans, potatoes, chickpeas, peaches, and other temperate-climate products. Half of Mexico's onions and two-thirds of its peanuts grow in these fertile valleys. The largest wheat areas are in the central part of the basin from Querétaro to Guadalajara, whereas the peanuts are concentrated in a small area around the latter city. León, in the State of Guanajuato, is the center of the potato industry, although the product extends throughout the higher altitudes. Peaches and other deciduous fruits are more plentiful in the eastern than in the western section. In the warmer western areas near the Pacific Ocean, sugarcane, coffee, rice, oranges, and bananas thrive. Tobacco is also important there.

Although feeder cattle for export are raised in the northern border States of Mexico, the Central Plateau contains the major part of the country's cattle population. The State of Jalisco has more cattle than any other.

In agriculture, as in climate and its resources, the Lerma-Santiago drainage basin is representative of Mexico, producing a wide variety of commodities ranging from highland potatoes to tropical bananas, from dryland guayule to moisture-loving coconuts.

Brazil, Giant to the South, by Alice Rogers Hager (photographs by Jackie Martin). 80 pp. The Macmillan Company, New York, 1945. The author tells the story of Brazil in pictures with a running accompaniment of brief selected text. A panoramic view is given of the country's geography, history, peoples, government, cities, products and industries, rivers, transportation, customs, education, achievements in fine arts, and "Toward Tomorrow."

New Crops for the New World, edited by Charles Morrow Wilson. 295 pp., illus. The Macmillan Company, New York, 1945. This book contains the stories of important New World crops, each told by an authority in that field. The chapters deal with tropical fruits, maize, livestock breeding for the New World, palm oils and waxes, rubber, cinchona, drug and medicinal crops, biological control of insect pests, forest resources, silk, bamboo, peppers, flowers, cane sugar, the transplanting of native crops from one part of our hemisphere to another, and the introduction of economic plants. The list of authors includes Wilson Popenoe, Edgar Anderson, Albert O. Rhoad, Miriam L. Bomhard, Walter N. Bangham, E. C. Higbee, C. P. Clausen, Arthur Bevan, George E. Adames, Atherton Lee, A. T. Erwin, B. Y. Morrison, P. Honig, and V. C. Dunlap.

Botánica Aplicada a la Farmacia, by Manuel Quirós Calvo. 214 pp., illus. Volume II of the *Colección de Textos Universitarios,* of the University of Costa Rica, San José, Costa Rica, 1945. This book on botany as applied to pharmacy contains sections on the external morphology of plants, brief descriptions of medicinal plants with indication of their uses, a reference table of the plants mentioned in this book, giving their scientific and common names, origin, parts used, properties, and uses.

El Cultivo del Arroz, by Ricardo G. Hepp D. 14 pp., illus. *Director General de Agricultura,* Circular No. 1. Santiago, Chile, 1945. This circular tells of the cultivation of rice in Chile: The history and importance of rice in Chile, the regions in which it is grown, the methods of cultivation, harvesting, and drying which are used.

The Very Good Neighbors, by Irmengarde Eberle (colored drawings by Flora Nash DeMuth). 96 pp., illus. J. B. Lippincott Company, New York, 1945. Here is a story for very young boys and girls, of a Mexican family who came to live in southern Texas. The entire family—father, mother, and three children—worked in gardens and homes of San Antonio to earn the money for the dry beans, salt, meal, chili peppers, and meat that formed their diet.

EDITOR'S NOTE.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

AGRICULTURE IN THE AMERICAS — O. R. CARRINGTON, EDITOR

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Gifts of the Americas

THE PUMPKIN

by HUBERT MANESS

The pumpkin is one of the many new vegetables which the Europeans learned to eat upon their arrival in the New World. It was found growing in many areas throughout the Western Hemisphere and quickly became a staple food of the settlers as it had been of the Indians for hundreds of years. The Spanish and Portuguese accepted it as a vegetable, but the hungry Pilgrims in New England first ate it as a dessert.

The Indians served pumpkin after baking it in the shell for hours over hot coals. It was truly sweet in contrast to the other food they consumed and was much appreciated, as there were few sweets in the diet. A natural development of this delicacy was the pumpkin pie, which in the early days consisted only of baked pumpkin and crust. It was later enriched with sweet molasses from the West Indies, and thus the first truly North American dessert was created. Pumpkin pie has spread to other countries, but it has never attained the popularity it holds in the United States. This dish is considered essential for the Thanksgiving feast and holds a warm place in the hearts of Americans when this unique New England holiday is celebrated.

The pumpkin has many uses and is widely eaten not only in North America but also in Central and South America. The staple diet of many present-day people "south of the border" is still composed of foods native to the Americas, such as beans, corn, and pumpkin. One of the most common uses of the pumpkin is as a mixed vegetable in the numerous meat stews which so characterize the food of Central and South America. Cooked pumpkin is also mashed with egg and formed into delicate little cakes and fried in deep fat until they are golden brown. Mashed pumpkin mixed with herbs and blended with meat broth makes a delicious soup which is the specialty of many restaurants in South America.

Pumpkin seeds are highly nutritious and are used as food in many places of the world. In Mexico and Central America roasted pumpkin seeds are as popular as peanuts in the United States. These roasted seeds are sold by peddlers and from little stands, where passers-by stop to purchase them and continue their stroll down the street joyfully eating the seeds by cracking them with the teeth. In cities of the United States they are sold—roasted and salted—in the stores. Many tribes of Indians make a meal from the seed and use it for bread making or for gruels.

Some people think of the pumpkin and squash as separate vegetables, but there is no accepted basis for distinction between them. Botanically they make up three species of the genus *Cucurbita,* which belongs to the Cucurbitaceae family. The fruits are produced on vines, most of which run along the ground or climb over other plants. Some forms have such short or compressed stems that they grow in a dense clump or "bush." So-called field pumpkins may belong to either of two species, *Cucurbita pepo* or *C. moschata.* One common form, Connecticut Field pumpkin (*C. pepo*), is orange-colored when mature and has a shell that is firm but not nearly so hard as the rind of squashes that are stored for winter use. The layer of flesh inside the rind is the part that is cooked and eaten.

Modern man has been able to improve many types of native American vegetables, but pumpkins were so well established and had been grown so long by the Indians that the white people have done little to improve pumpkin varieties except to select early maturing varieties, increase uniformity, and improve the color. No new types have been developed which were not known to the Indians. Archeologists have established the fact that the various types of pumpkins and squashes, from the big yellow Jack-o'-lantern pumpkin to the little crookneck and scalloped squashes, were all known to the Indians long before the European settlers came to the Americas.

For many years the exact place of origin of the pumpkin was undetermined, but archeologists have recently brought forth evidence establishing the central part of the Western Hemisphere as its native home. Numerous seeds and fragments of pottery have been found in the American Southwest which indicate that pumpkins were known to the Basket Makers, an Indian civilization that existed about 2,000 years ago. The prehistoric cemeteries near Lima, Peru, have furnished similar evidence of the pumpkin's early existence. Funerary vases have been found, some modeled after pumpkins and others having striking resemblance in details to the Summer Crookneck squash. Most of the varieties grown today originated in the Mexican-Central American region or in the Peruvian-Colombian-Ecuadoran region. From there they were probably taken to the other areas in all the Americas wherever climatic conditions favored their growth.

From early times the European settlers carried pumpkin seed back to the Old World, and now pumpkins are almost as popular there as in the Americas.

LERMA-SANTIAGO RIVER BASIN—MEXICO

by **Kathryn H. Wylie**

Río Lerma-Santiago, in the west-central part of Mexico, flows north and west through a series of descending basins to drain a large part of Mexico's granary. It is the second-longest river in the country, exceeded only by the Río Grande, or Río Bravo as it is called "south of the border." The area drained by this river and its numerous as well as important tributaries occupies less than 7 percent of all Mexico but contains about one-quarter of all the people.

Rising in the plateau country about 30 miles west of Mexico City, the Lerma travels north through a basin 8,600 feet above the sea, turns sharply to the west and surges through a narrow gorge into the Guanajuato Basin, and continues westward to the Jalisco Basin, where it empties into Lake Chapala, the largest lake in Mexico. When the main stream leaves the lake, it is called Río Grande de Santiago. Not far from the city of Guadalajara the river plunges down a cliff to form the Juanacatlán Falls, 50 feet high and 430 feet wide. From here the Santiago drops 5,000 feet in 275 miles, sometimes flowing 2,000 feet below the surrounding country, and empties into the Pacific near San Blas.

The network of tributaries, most of which enter the river from the right bank, reaches into rich mining country and extends north well into the State of Zacatecas. Included in the drainage basin are all or parts of the States of Nayarit, Jalisco, Durango, Zacatecas, Guanajuato, Aguascalientes, Mexico, Michoacán, and Querétaro.

Its People and Resources

The first area of Spanish settlement from Puebla west to Guadalajara included the mountain valleys drained by the Lerma-Santiago. Here the Spaniards found accumulated wealth ready for the taking, favorable climate, productive soil, silver and gold mines, and a dense Indian population to furnish the necessary labor for exploitation. Long before Cortez came,

(*Continued on page* 216)

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NAMES & NEWS

President of Chile Tours United States

Juan Antonio Ríos, President of Chile, arrived back in his native country on November 28 after a tour of 2 months which took him to the United States, Canada, Mexico, and a number of Central and South American countries.

During his 3-day stay in Washington, President Ríos was received by President Truman and other high officials of the Government. He visited Congress, lunched at the Capitol, attended a reception at the Chilean Embassy, inspected the U. S. Department of Agriculture Research Center at Beltsville, and saw a number of places of historical importance.

The Chilean President also visited New York, Philadelphia, Chicago, Los Angeles, San Francisco, Miami, and Ottawa, closing his North American trip with a stop in Mexico. From Mexico he went to Guatemala, Costa Rica, Panama, Venezuela, Brazil, Uruguay, and Paraguay. Peru, Ecuador, and Colombia were visited en route to the United States.

Included in the official party accompanying the President was his son, Lieutenant Carlos Ríos.

●

Oscar Riddle Visits South America

Oscar Riddle, nationally known biologist and former president of the American Society of Zoologists, recently visited a number of biological institutes and other scientific centers in South America. One of the purposes of his trip was to confer with scientists on the best methods for making scientific information interchangeable and available in the various Central and South American countries.

During his trip Dr. Riddle delivered a number of lectures in Rio de Janeiro, São Paulo, Montevideo, and Buenos Aires.

●

Octavio Domingues Returns To Brazilian University

Octavio Domingues, of the faculty of the College of Agriculture, Rural University, Rio de Janeiro, has returned to Brazil after conferring with representatives of the Bureaus of Dairy and Animal Industry, U. S. Department of Agriculture.

Venezuelan Veterinarian Is Visitor to U. S.

Dr. Juan José Ramírez Villamediana, Head of the College of Veterinary Medicine, University of Caracas, has been visiting centers of agricultural education in the United States as a guest of the Department of State for the last 2 months. He is especially interested in observing methods of teaching and research because of the development of the new National Institute of Agriculture which is under construction in Venezuela. The Institute is located at Maracay, in the center of the Venezuelan cattle region, and will include thirty buildings for residence and instruction. The Institute was begun last February and will be completed in 1947.

Dean Ramírez Villamediana's trip included the States of New York, Pennsylvania, Maryland, Ohio, New Jersey, Illinois, Iowa, Kansas, Louisiana, and Texas. This will be followed by a visit to a number of Central and South American countries under a grant by the Rockefeller Foundation.

●

Physiologist Visits Haiti and Dominican Republic

H. A. Allard, Senior Physiologist, Bureau of Plant Industry, Soils, and Agricultural Engineering, visited the Dominican Republic and Haiti this fall for the purpose of collecting tobacco seed to be used in the improvement of varieties adaptable to tobacco culture in the United States. He also collected herbarium materials of wild and economic plants for the Smithsonian Institution.

●

Director of Bolivian Station Named

Arthur T. Semple, of the Office of Foreign Agricultural Relations, has been named Director of the recently created Cooperative Agricultural Experiment Station in Bolivia. Prior to assuming this new position Mr. Semple will serve as Acting Director of the Nicaragua Experiment Station in the absence of Arthur J. Kevorkian, who is on triennial leave.

●

Dr. Goncalves Returns to Brazil

Dr. Paulo Annes Goncalves, representing the Meat and Rice Institutes of the State of Rio Grande do Sul, has returned to Brazil after spending a year in the United States. Before leaving, Dr. Goncalves conferred with USDA officials in Washington and Beltsville on agricultural economics and farm machinery.

Agriculture IN THE Americas

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Brazil's Sugar Industry

Sugar produced in Brazil brought gold to the coffers of the Portuguese Crown for more than 200 years, and it plays a large part today in Brazilian economy. "Sweet gold" it might well be termed.

by HUBERT MANESS

The Portuguese started settling along the coast of Brazil soon after the beginning of the sixteenth century and, like their Spanish neighbors, began searching for quick wealth in the form of gold. Failing in this, they turned to the rich soil of Brazil, cutting down the lush tropical forest which grew along the coast and planting the land to sugarcane.

Europe was hungry for this energy-giving sweet which, before Brazil began producing it in large quantities, had been worth almost its own weight in gold. The early Portuguese were quick to capitalize on the newly found almost-limitless sugar lands and by 1526 were shipping sugar from Brazil to Portugal for sale in Europe. More and more land was planted, until it extended along the Brazilian coast for several hundred miles, from the Colonial capital at Bahia northward beyond Pernambuco.

Sugar Trade Through the Centuries

This gave the Portuguese a monopoly on the world's sugar market which lasted almost 200 years. In fact, the whole economy of Brazil centered around sugar production, and, with the wealth which sugar brought, many beautiful buildings and churches were built. Other countries, greedy for this new wealth in Brazil, became keenly interested in obtaining possession of the lands. The Dutch conquered the Northeast and for the 30 years between 1624 and 1654 were its masters. Evidence of this war can still be seen in the Dutch names and features of many of the people of the Northeast.

Sugar supremacy came to an end about 1700 when gold was discovered in large quantities in the State of Minas Gerais. Many planters moved their slaves, work oxen, and capital to the gold mines, abandoning their sugar lands. Mule roads for carrying the precious yellow metal to the seacoast were opened up from Minas Gerais through the steep passes of the mountain range to the port of Rio de Janeiro, and within a few years the capital was moved from Bahia to Rio de Janeiro.

Until the latter half of the nineteenth century, however, sugar remained a chief source of Brazilian wealth. Then, as the beet-sugar industry developed in Europe, importation of Brazilian sugar was restricted, and the competition of new areas such as the West and East Indies gradually put

A picturesque team of 10 oxen turning the soil in the valley of the Paraíba River.

Sugar plantation hillside in the State of Pernambuco, showing terraced land for the new crop. The ancient aqueduct carries water across the valley to the lower fields of cane.

Brazil in an unfavorable competitive position in the world sugar market. From that time, although deprived of extensive export markets, Brazil's sugar industry continued to expand to meet the growing domestic needs, and for many years a steady increase in production has paralleled growth in population.

World War I provided temporary expansion of trade opportunities with European countries whose beet fields had been laid waste by war. Exports, which were around 35,000 short tons a year in 1914, increased rapidly, reaching a peak of 278,000 short tons in 1922, after which they decreased to between 40,000 and 45,000 tons a year. Production started to increase again after 1930 and continued steadily until between 1936 and 1940 it averaged about 1,159,000 short tons a year. In 1944 production was 1,486,000 tons.

Sugarcane is grown at present in all the States of Brazil, but there are two main centers of production, one in Northeastern Brazil and one in Southern Brazil.

During the last 2 years the author has served as Vice Consul in the Agricultural Attaché's Office of the American Embassy, Rio de Janeiro.

Sugar Areas in Northeast

The industry which was established in the Northeast in the days of sailing craft when nearness to European markets was an important factor has persisted even though the region is a considerable distance from present domestic consuming markets. This Northeastern sugar area is mainly confined to a narrow coastal strip, about 40 to 60 miles wide, along the bulge of Brazil. The hot humid climate is decidedly tropical. Average annual temperature is between 75° and 79° F. Annual rainfall is rarely less than 47 inches. Rains are heaviest in March and April and again in September and October.

The coastal strip is bordered on the west by the *sertão,* a dry plateau in the interior of the country. Droughts occasionally extend from the *sertão* to the coastal plains, causing as much as 75 percent reduction in sugarcane yield and necessitating the use of irrigation. In other years heavy rains falling in the *sertão* between January and March cause the rivers flowing down to the coast to overflow the

cane fields. Cane in these bottomlands is, therefore, harvested by November or December to allow the ratoons, or second year's growth, to attain sufficient size to withstand flooding.

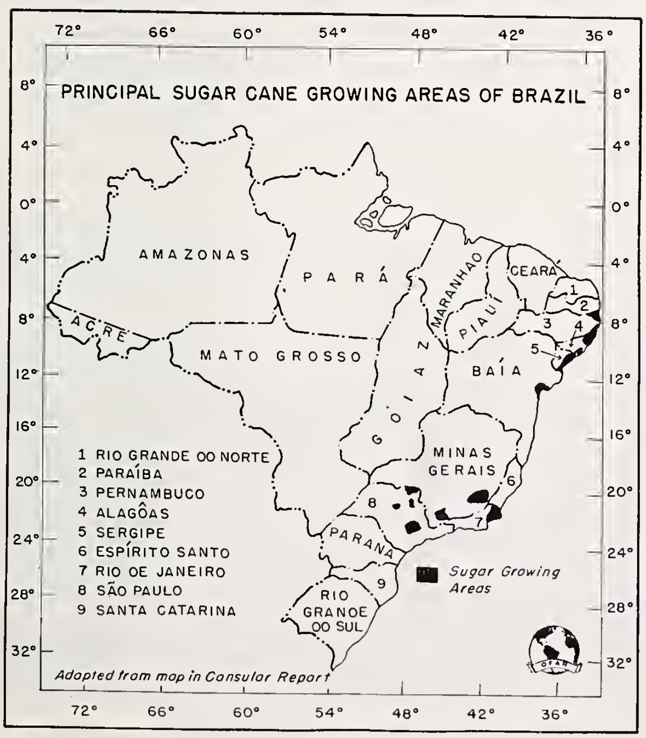
The narrow belt of fertile soils in the Northeast was formerly covered with semi-deciduous forests. Clearing away the forests brought to light a deep dark-red soil, underlaid with crystalline rocks. The soil was exceptionally rich in humus and gave extraordinarily high yields. Cane is still growing on some of the same land that was planted more than 400 years ago in Colonial times.

Sugar Areas in the South

The sugar areas of Southern Brazil are mainly in the States of Rio de Janeiro and São Paulo. Temperatures are not as constant as in the North. The low-lying areas of Campos, which produce about 70 percent of the sugar for refining in the State of Rio de Janeiro, have an average annual temperature of 72° to 73° F. Because of their elevation, the sugar areas of São Paulo and Minas Gerais have a sub-tropical climate. In São Paulo there is always the possibility of frosts.

Rainfall in the South averages about 13 inches a year less than in the Northeast. Precipitation is more regular, however, during the vegetative period of the cane, and there is far less evaporation. The rainy season begins in October or November and ends in March or April.

Sugarcane in the State of Rio de Janeiro is mainly planted in the valley of the Paraíba River. Some of this soil is exceptionally fertile, but along the delta it is relatively shallow. Throughout the area, including Minas Gerais and São Paulo, there are many small river valleys where sugarcane is grown.



Sugarcane is hauled from the fields on small donkey cars and weighed before loading on the narrow-gage railroad for transport to the mill.

Sugar lands in Northeastern Brazil are for the most part still controlled by families many of whom can trace their possession from the Portuguese Crown. For generations during the era when sugar production was prominent in Brazilian economy these old Colonial families dominated life in Brazil, and even today they are prominent in the social and political life of the nation.

On the other hand, much land is held by squatters' rights in small plots, especially in the lands west of the rich coastal belt. The total amount of such land is far greater than the acreage of the large plantations, and these owners, who operate more than 50,000 *engenho* mills, also form a strong social and political influence.

In the State of São Paulo much of the sugar land is in the hands of coffee planters, who manage their sugar lands much as they do their coffee lands.

The Laborers

In contrast to land-holders, a large number of laborers live on or near the estates. They support the old methods of operation and, regardless of their low income, many of them are loyal to the traditional owners of the land.

In general, the sugar mills make contracts with laborers and furnish houses, land for growing foodstuffs, and medical care, and maintain free public schools. Tenants buy from the company store on credit and the accounts are settled at the end of the harvest. A family of five can care for approximately 50 acres of cane. On some estates the mill owners are building better homes for the workers, to counteract the more lucrative jobs offered in the cities.

Often the laborers grow a few furrows of sugarcane for making syrup or their favorite drink *cachaça*. In Brazil, unlike the other sugar-producing countries of the Americas, highly refined rum is not generally made. Instead, *cachaça* is made from sugarcane. It is a potent, quickly distilled, white drink, highly popular with a large percentage of the population. It is generally taken straight and is always served with *feijoada*. *Feijoada* is made of black beans, dried beef. and vegetables, and might be called the national dish.

Sugarcane is planted in Brazil much as it is in other sugar-producing countries. In the productive lands modern machinery is used, the sugar industry using more modern agricultural machinery than any other crop grown in Brazil. On the lower-yielding lands, however, manual labor is used almost exclusively.

Cultivation Practices

In hilly areas much of the land is not broken before making the furrows, and on some of the flood lands furrows are not used at all. Instead, the cuttings are placed in holes made with a stick. When furrows are used, they are generally about 5 feet apart. When possible, they run east and west, but often they run up and downhill, and in some instances follow the contour so as to be easily irrigated. Before planting, the furrows are often flooded.

Planting stock is usually taken from cane fields 10 to 12 months old. The cane is cut smooth in pieces containing at least 3 eyes. The cuttings are placed horizontally in the furrows or holes about a foot apart, with the eyes on the side. From 2 to 2½ tons of cuttings are used for an acre, depending upon the variety used. The practice of growing improved varieties especially for planting is receiving encouragement.

In the Northeast, planting generally starts in June and July for year-and-a-half cane, that is, cane which will be cut in September or November of the following year. Annual cane is planted in November, December, or January and is harvested in these same months the following year. In the drier border areas year-and-a-half cane is planted on the upland in May and June so that the dry season will find the young cane with 4 or 5 months' growth. In Southern Brazil, planting of annual cane takes place in September and October and that of year-and-a-half cane in January, February, and March.

The grub hoe is the principal instrument used in the cultivation of the cane. Some fields are hoed as many as 10 times in order to keep down the weeds. On the better lands cultivators are used. During the past 10 years, especially in the Northeast, irrigation is becoming a common practice.

Everywhere throughout the cane fields of Brazil oxen are indispensable. They are used for plowing the land, for pulling the heavy two-wheel carts, and for turning the press in some of the small mills.

Many pests infest sugarcane in Brazil, including the destructive sugarcane borer. About 1923 to 1928, mosaic disease was widely prevalent in the cane fields of Southern Brazil, but it is being controlled by the introduction of resistant Javanese and Indian canes in many areas.

The average period for producing cane is 4 years, or 3 crops. On the poorer hilly land a common practice is to replant after each harvest, whereas in some of the richer areas cane 20 years old is still yielding satisfactory crops. In São Paulo 4 to 5 years is considered an average.

The cane is cut by hand, with a long knife called a cane knife. The cane is then hauled to the mills, often by oxcart.

Milling the Cane

When the mills are fully equipped with laboratories for analyzing cane, the price paid for a ton of cane will be determined by the amount of sugar that it will render. At present, sugarcane is purchased largely on a weight basis.

There are two kinds of sugarcane mills in Brazil. Much of the sugar is produced by small mills known as *engenhos*. In this older kind of mill the sap is boiled in pans directly over wood fires, and only a few sacks of sugar are produced in a year. Many *engenhos* are located in out-of-the-way places and grind from small patches of cane grown mainly for family consumption. The sugar from these mills is called *rapadura*. It is a coarse brown sugar much like our

(*Continued on page* 234)

Typical Brazilian narrow-gage train for transporting sugarcane from the fields to the mill.

Marabú in Cuba

Thousands of acres of agricultural land in Cuba are overrun by a plant known as marabú. Eradication of this pest is a serious problem.

by JULIAN C. CRANE

The danger of inadvertently introducing noxious plants into a country is one which should be carefully guarded against. This hazard can be reduced to a minimum only by careful government supervision in all matters pertaining to foreign-plant introductions and by carefully observing the plants for several years following their introduction, in order to detect early potential harm and eradicate undesirable plants. The difficulty of foretelling whether a new plant will actually become a serious pest does not excuse its introduction if tendencies in that direction are already known. Such an act will not readily be overlooked by the practical farmer who is constantly annoyed by the presence of the plant in his fields.

Introduction Dangers

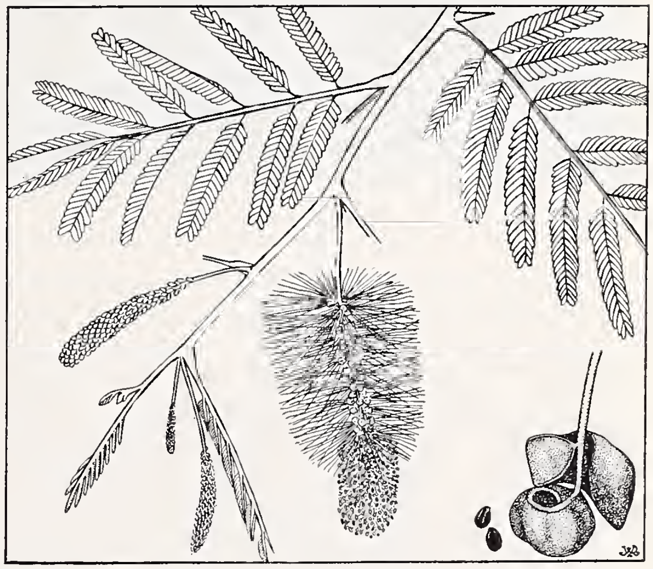
Practically every country has been plagued, at one time or another, by some introduced plant which has caused the expenditure of a great amount of labor and expense in its control or eradication. In the southern United States the water hyacinth that has clogged the rivers and lakes, making navigation almost impossible, developed from an apparently harmless ornamental plant introduced from Venezuela about 60 years ago. The Russian thistle, introduced with flaxseed into South Dakota, is a more-or-less troublesome weed on thousands of square miles of farming land.

Cuba has not escaped the problems associated with the introduction of a weed plant. The splendor of the "Pearl of the Antilles," as the island is often called, is blemished in many large areas by almost impenetrable stands of a plant known as *marabú* (*Dichrostachys glomerata* (Forsk.) Chiov.).

According to one native legend, *marabú* was introduced into Cuba because of its ornamental value. Today, however, its beauty is obscured, in the eyes of most people, by the tremendous problem it presents to the farmers and cattlemen as it encroaches at an alarming rate upon their farm and pasture lands. Fear exists about the possible consequences if measures are not undertaken to control it.

There is about as much speculation as to how and when *marabú* was introduced into Cuba as there is concerning the chances of its eradication. The exact date of its introduction is not known, but, because no reference to this plant is made in the rather extensive botanical literature on Cuban flora as late as 1873, one is led to believe that it made its appearance on the island sometime during the latter part of the past century.

The author is Associate Agronomist in the Office of Foreign Agricultural Relations and for some time conducted experimental work in collaboration with the Cuban Ministry of Agriculture. At present he is stationed at the Cooperative Agricultural Experiment Station in El Salvador.



Flowering branch, seed pods, and seed of the *marabú* plant.

Other Legends

In the Province of Camaguey, where the name *marabú* was given the plant, legend tells us that a rich widow, having a fondness for plants, introduced it as an ornamental for her garden from Africa, perhaps from the French colony of Senegal. She was warned of the potential trouble-maker the plant could be and was told to destroy all seeds it produced. During the Spanish-American War the Spanish troops passed through her farm several times, and *marabú* is believed to have begun its advance over the island in the stomachs of horses that ate the fruit produced by the plant. This story is a logical one, as *marabú* is found principally on land situated near roads and along rivers.

From Pinar del Rio, the province occupying the westernmost portion of the island, comes the popular version that José Blain, dean of Cuban botanists, was responsible for the entrance of this troublesome plant. Among the several exotic species of plants which he introduced for his botanical garden in Pinar del Rio Province was *marabú*. This story

Courtesy Cuban Agricultural Experiment Station
Cutting *marabú* with machetes preparatory to planting land to sugarcane.

is discredited, however, by some of the elderly Cubans who remember that many years ago the area around Trinidad, a city situated relatively distant from either the rich widow's garden in Camaguey or José Blain's botanical experiments in Pinar del Rio, was more overrun by the plant than the places where it was supposed to have been planted first.

A third narrative, not so common among Cubans but believed by some to be better founded than the others, relates that the plant was brought into the country by foreign livestock which were imported after the War of 1868 to repopulate the dairy farms. Cattle are said to have been imported at that time from places where *marabú* existed.

Its Characteristics

Marabú is a spiny, much-contorted shrub or small tree, seldom growing taller than 12 or 15 feet, which belongs to the Leguminosae family. Its growth habits and bi-pinnately arranged leaves with small leathery leaflets are responsible for the fact that the plant has been referred to at different times by the common names mimosa and acacia. The tree so closely resembles *Acacia farnesiana* Willd. L., known to Cubans as *aroma* or *aromo amarillo* (*amarillo* means yellow), that the vernacular names for the two plants are used interchangeably, particularly in certain sections of Santa Clara Province. The two plants are easily distinguishable, however, according to a Cuban botanist, by the fact that two spines are found together on the branches of *aroma,* whereas only one spine at a given location is present on the branches of *marabú*. In addition, the spines of *aroma* are longer, though weaker.

Other more localized names are *aroma francesa, espina de diablo* (devil's thorn), and Weyler. Oddly enough, the name Weyler was taken from a man who was thoroughly hated in Cuba. Valeriano Weyler, a subordinate officer to the Spanish Commandant in the city of Bayamo, gained his epithet "The Butcher" in carrying out the drastic orders of his superior officer during the Ten Years' War.

The most widely used name, *marabú,* meaning half-breed, was probably given this plant because of its bi-colored flowers, which hang from the branches like Christmas tree ornaments, in spikes 3 to 4 inches long. In the upper half of the spike the perfect flowers are sulfur-yellow in color, the lower ones are rosy lilac and staminate. During April the plant bursts forth with many of these bi-colored flowers, which have somewhat the appearance of small bottle brushes. Blossoming continues through the spring and summer months, followed by the development of the fruits or seed pods in the fall. During the winter months the plant loses its leaves, and the branches are profusely laden with dried and twisted seed pods 3 to 4 inches long and generally less than one-third of an inch broad.

The profusion with which *marabú* produces seeds, together with the fact that the fruit is eaten by cattle, probably accounts for its rapid progress throughout the island. Although the percentage germination of the seeds is not high, the plant has become established in many out-of-the-way places as a result of the dissemination of seeds by streams of water and in the stomachs of cattle and horses.

Extensive Taproot System

The plant has an extensive taproot system which in good soils penetrates to depths of 9 to 15 feet. In addition, numerous lateral roots, situated at varying depths but usually near the soil surface, extend in all directions to considerable distances from the trunk. The lateral roots are the principal means by which the plant spreads so rapidly and by which it propagates itself. The lateral roots are responsible, moreover, for many failures when attempts are made to eradicate the plant. When a tree is cut down, the lateral roots near the soil surface soon produce aerial shoots. Similarly, if removal of the roots is attempted, any small pieces left in the ground may become new plants in that they immediately begin to send out small fibrous roots and produce above-ground shoots.

Whenever sugarcane or other crop land is abandoned even for a short time, such areas provide optimum conditions for the establishment of a *marabusál* (*marabú* thicket) in that *marabú* plants do not have competition from others for sunlight. Individual trees make their appearance here and there and, as the plant never grows isolated without forming compact masses, the advance over the land begins by means of the horizontal root system and seeds. The plant is a rapid grower. In 3 or 4 years it reaches a stage where it drives out other growth, though 10 to 15 years are required for it to acquire its full height.

During the initial stages of the formation of the thickets the denseness of the plants and the presence of stiff sharp thorns make them almost impenetrable to man or animal. With increasing age and size of the plants, the lower branches and smaller trees are gradually suppressed and die as a result of being shaded, making it possible for a person to traverse the area without great difficulty.

Marabú appears to be relatively free of disease and insect pests. Several saprophytic and parasitic fungi have

been reported to attack the plant, but only slightly.

Heavy-textured soils, especially those with large amounts of clay, seem to furnish the requirements of *marabú* for good growth. On the other hand, immense formations of the plant have been observed growing in the sandy soils of Pinar del Rio Province and thriving in Santa Clara Province on clay loam soils which have an abundance of quartz gravel at the soil surface.

Marabú is found growing extensively in all the provinces of Cuba. In the cattle-raising Province of Camaguey some farms have been abandoned because they were completely overrun by this pest. Since it grows, to a considerable extent, along the railroads, some people believe that the seeds have been distributed in this province by manure from the cattle cars.

Even though the plains appear to offer ideal conditions for the plant, it is found at comparatively high elevations also in the Trinidad Mountains, located in the southern part of Santa Clara Province. In this region and around the city of Cienfuegos the tree is uncontrolled and forms dense forests on land which was formerly used for sugarcane. Reports state that tracts of land 13,000 acres in extent have been so completely overgrown with *marabú* in a period of 10 years as to render the land useless for agricultural purposes. The exact area occupied by *marabú* in Cuba is not known, but it is safe to say that the plant has spread over hundreds of thousands of acres.

Redeeming Features

The most redeeming feature of *marabú* is its usefulness in the making of charcoal. The sale of charcoal annually amounts to around $2,000,000 in Cuba and is a good source of income for some of the rural people. Were it not for extensive areas of land covered with *marabú,* the necessity for importing this important fuel material might have arisen. During the early history of Cuba the forest resources were greatly depleted by shipments of lumber to Spain. More severe destruction occurred after the first World War, when the sugar industry was widely expanded onto lands which were found to be sub-marginal for normal sugar production. Extensive forest areas were cut over and burned. Much of this land had, eventually, to be abandoned. As there was no reforestation program in Cuba, it was perhaps a good thing that *marabú* took over this land so that charcoal could be produced.

Like all plants of the family of Leguminosae, *marabú* is a soil builder in that on its roots are soil-bacteria which utilize or fix the free nitrogen of the air and convert it into food for succeeding crops. Sugarcane lands abandoned because of low-yielding capacity are said to be markedly improved after *marabú* has grown on them for several years. In addition to improving the soil, this plant, because of its dense ground cover and extensive root system, retards erosion on land which otherwise might be ruined by the forces of nature.

The wood of the full-grown tree is used to a minor extent in making canes and furniture and is preferred as a fuel by some bakeries. The bark and wood contain comparatively small amounts of tannin. From time to time establishment of mills has been considered for the extraction of this tannin and other substances, with the residue being pressed into bricks for the manufacture of charcoal.

Additional uses, apparently unknown to the Cubans, are mentioned in the literature. The natives of West Africa obtain fiber from the bark as well as material used as a vermifuge. Roots of the plant are made into tool handles and bows, and the smaller ones are used for basket weaving.

Eradication

If thousands of acres are to be saved for agriculture in Cuba, effective methods of eradicating *marabú* must be established. Tremendous cost and work are involved in the process. Individual trees may be killed by the application to the roots of such materials as crude petroleum, salt, kerosene, and sodium arsenite, but on infested areas of any size the cost of such a procedure is prohibitive. Likewise, the residual effect of these materials on subsequent crop production has not been determined under Cuban conditions.

Slashing and burning, followed by the cultivation of some fast-growing and shade-producing crop has been the most satisfactory method of eradication to date. Sugarcane has been used most frequently for this purpose, but repeated

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Courtesy Cuban Agricultural Experiment Station

To make charcoal, *marabú* wood is stacked in piles and covered with a layer of moist earth before being ignited.

Ecuadoran Agriculture Looks to the Future

Ecuador's agricultural history is a long and varied one, dating back to the Incas. Ecuador now turns attention to new technological problems involving farm machinery, varieties of crops, and methods of production, marketing, and transportation.

by **LAWRENCE WITT**

Agricultural methods existing at the time of the Spanish Conquest of South America have been changed and improved with the passage of the centuries, in some areas of the hemisphere more effectively than in others. In some of the Andean regions technological changes have come less rapidly, and in certain phases of agriculture these regions have become followers to a large extent instead of the leaders they once were. Now they are looking for leadership and technical assistance in revamping their patterns of agricultural production.

To aid in accomplishing this development in Ecuador, an agricultural experiment station has been established at Pichilingue, Los Ríos Province, in the Ecuadoran lowlands by the U. S. Department of Agriculture and the Ecuadoran Ministry of National Economy, which has responsibility for agriculture in Ecuador. Here the problems that confront Ecuador's farmers are being studied through mutual cooperation between the two countries.

Because of the high altitude and cold climate colorful ponchos are worn by farm workers in the field.

If we are to understand these problems, we must know what Ecuadoran agriculture was like in the early days. Before the Conquest, production was carried on by hand. Plowing was done by foot power with the aid of a simple spade-like instrument, or by a wooden plow pulled by other agricultural laborers. Oxen were introduced many years later by the Spaniards. Simple hoes, sometimes pointed with copper or bronze, were used to keep down competing growth. Harvesting and threshing were done by hand, and the grain was ground in wood or stone mortars. The art of irrigation, however, was well advanced in certain regions.

Corn and potatoes were the basic crops, with beans and the cereal quinoa (*Chenopodium quinoa*) as important supplements. A fair variety of fruits and vegetables were grown, both in the highlands and in the lower valleys, and the sub-tropical valleys in Ecuador and Peru permitted the production of certain species of cotton.

Llamas and closely related animals were second in importance only to corn and potatoes in the early economy, being used both for light transport and as producers of wool. Guinea pigs and dogs were the only other domesticated animals.

The entire system of agriculture was carefully supervised and controlled by the closely knit Inca State, primarily to insure the proper payments of taxes and tributes, but also to insure uniformity of production methods and procedures. The Incan hierarchy was arranged so that officials in seven ranks were in charge of stated numbers of households, ranging from 10 to 40,000. Above these were the four officials in charge of the four parts of the Empire, and above them the Inca. The lower officials could and did

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A cultivated valley in the mountains north of Quito, showing a pattern of small fields and the steepness of the cultivated hillsides.

enter individual homes and farms to instruct in accordance with the latest orders from the central government, to insure the carrying out of the practices as ordered. Whether these instructions were always in line with the best-known practices of the period cannot be determined, but the system certainly provided means for raising subjugated tribes to the existing Incan level of production.

Changes Made by Spaniards

While the Spaniards were interested in gold, food supplies were necessary for living and for the support of laborers working in the mining of gold. Soon after the Conquest, therefore, attention was necessarily turned toward agriculture, as an essential part of permanent exploitation of the mineral wealth. The Spaniards gained access at one or another level of the Incan hierarchy through grants of large areas of land and the people living on them. This was known as the *repartimientos* system. They gradually took over the direction of the Indian farmers and absorbed the usual Incan taxes and tribute as their own income.

The Spaniards made certain positive contributions to agricultural production. The introduction of cattle, sheep, and chickens brought in new foods, and, in the sheep, a heavier wool producer than in the llama. Oxen, horses, and donkeys made effective beasts of burden, making possible plowing with simple wooden plows and transporting of materials over longer distances. Speed by which man could travel was also increased, although the Incas had already developed speedy transmittal of messages.

Wheat and other cereals were introduced, making cereal production possible over a wider range of altitude. Tropical products such as sugar, rice, and bananas were brought in early. Coffee was introduced much later. A number of native American plants, such as cassava (*Manihot esculenta*) and cacao, were distributed more widely in the lowland areas of Ecuador and other countries and made possible the greater utilization of the tropical lowlands. Many new fruits and vegetables were introduced from Spain, including oranges, apples, olives, beets, and carrots.

The net result of these changes was a wide expansion in the area cultivated and pastured, improvement in the productivity of the land, and an increase in trade and

Rice is threshed on a large cloth by hand-beating the dry stalks.

intercommunication between the various mountain valleys and the outside world. Although individual areas remained highly self-sufficient, that self-sufficiency was probably less than before. What the effect was upon the actual level of living of the isolated Indian farmer is difficult to determine.

Nineteenth and Early Twentieth Century Changes

During much of the period of Spanish domination, the Andean highlands remained technologically equal to or in advance of the rest of the Americas. When the dramatic changes of the nineteenth and early twentieth centuries occurred in the great areas of temperate-climate agriculture, the isolated agricultural regions of Ecuador failed to keep pace.

This was due to a multitude of factors. Among them were the isolation enforced by topography and distance, the nature of the hacienda system whereby many owners have little intimate contact with actual agricultural operations, and the low cost of labor which discouraged the introduction of labor-saving and labor-assisting devices. To a certain extent the inventions and developments were more suitable to the broad level lands of the pampas and great plains and were not adapted to Andean agricultural conditions except with many modifications.

Oxen are the principal source of power in Ecuadoran agriculture.

Recent Problems

Certain special problems have affected Ecuador in recent years. One of these has to do with cacao. Before the first World War, Ecuador was a leader in cacao production. The world increase in demand had stimulated cacao production, and the excellent natural conditions and short haul to market by way of the Guayas River gave that country some advantages over other producing areas. The infestations of witches'-broom and pod rot, however, in the lowlands have sharply reduced Ecuador's production and competitive position in world trade in cacao.

The introduction of new sugarcane varieties, particularly from Puerto Rico, has improved sugar production, even though Ecuador's ability to compete freely in that commodity with Peru and Cuba may be questioned. With the tremendous boom in coffee consumption in the late nineteenth century, coffee became an important commercial crop, but it has never attained in Ecuador the prominence which it reached in Colombia and Brazil. New varieties of wheat from North America have been introduced to a limited extent, but the production process remains fairly simple and the cost high. Alfalfa and other grasses have been introduced in the highlands to increase the forage-producing capacity greatly. A few tractors are in operation on scattered farms.

From time to time breeding stock of various old and new breeds of cattle have been introduced into both the highlands and lowlands to improve the old Spanish strains. At present some herds show moderately good milk- and meat-production records, but there is much to be done in improving both feeding practices and the type of animals. An added complication in cattle improvement is the fact that oxen are still prized as the most important beasts of burden in Ecuador.

Meeting the Challenge

There are many usable means of increasing production or of making production more efficient, although numerous factors limit the use of some large-scale modern agricultural practices. Up to the present, the recent improvements in agriculture have been applied in only a limited way by the great bulk of Ecuadoran farmers. The pressing problem of the near future is to spread the knowledge and use of these more efficient techniques among all the agriculturists in Ecuador. A further challenge is to devise and develop new techniques by which pests may be controlled, production per unit increased, production and marketing practices reorganized for greater efficiency, and levels of living increased as far as possible. This calls for new varieties of products, cultural practices, methods of assembling and grading, and many other improvements. Such problems are among those being studied at the Experiment Station.

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A New Tomato for the Tropics

Experiments in producing tomatoes suited to tropical conditions have been made at various places, including the National University of Costa Rica. The Inter-American Institute of Agricultural Sciences in Costa Rica here describes the origin and successful production of a new tomato called the "Turrialba."

by JOSEPH L. FENNELL

An unusual result in plant breeding has been attained with a new tomato now in process of development at the Inter-American Institute of Agricultural Sciences, Turrialba, Costa Rica. Just one year and a month after the wild, seemingly worthless parent was taken from the woods and crossed with a high-quality variety of the Temperate Zone, this new tropical tomato was being purchased and consumed in substantial quantities by the Armed Forces of the United States.

The "Turrialba" is, at this stage, in but the third generation from the original cross. Obviously, much remains to be done, as a new hybrid plant cannot, at so early a stage, have all its characteristics well established. Great need for a tomato of large size, better quality, and strong disease resistance, which would grow successfully in lowland tropics, rather than an attainment of perfection, has forced this new tomato into early commercial use.

The first cross was made in March 1944. The F_1 (first seeds from this first cross) were planted June 20. In November and December of the same year the entire second seed crop was planted. From the 25,000 fruiting plants which came from this planting, about 400 crates of standard-grade tomatoes were purchased by and for the Armed Forces. Also, the fruit from more than 300 carefully mass-selected plants of the group was reserved for seed, and perhaps 60 percent of the others discarded as the most inferior segregates. A strictly commercial planting of 15 or more acres was made, in the third generation, 16 months from the original cross.

Result of Experimentation

The tomato, useful plant as it is, has not been a success in many parts of the lowland tropics. Though in its wild forms the plant is native to tropical latitudes, nearly all the present-day improved kinds have been developed in the temperate zones and for temperate-climate conditions. When these kinds have been planted in the warm humid regions, only mediocre results have been the general rule.

The new "Turrialba" is firm-meated, bright red throughout, and has a moderately smooth, blemish-free skin.

From the beginning of our investigations with food crops at the Institute in Costa Rica much attention has been focused on the tomato. Variety after variety was put under trial, 28 in all, including most of the better-known commercial kinds that would seem to offer value for the Tropics. Not one of this group has shown any real promise at Turrialba.

Success at Last

Persons familiar with the warmer lowlands no doubt have observed in the markets at various seasons substantial quantities of small, cherry-like, or even rough and wrinkled, tomatoes. The wrinkled fruit condition of some types results from a compound-ovary manifestation of the flowers of the smooth cherry kind. This compound formation produces larger-size fruit of a compound-cellular nature, as contrasted to the small, two- or three-cell condition of the regular cherry type. A form of this wild tomato was one parent of our new "Turrialba." The other parent was Cuban Marglobe.

The wild type employed in the cross was a compound-ovary, lace-leaved selection of *Lycopersicum esculentum* var. *cerasiforme,* one of the cherry-like kinds. Larger fruit size, solid texture, more numerous and smaller seed cav-

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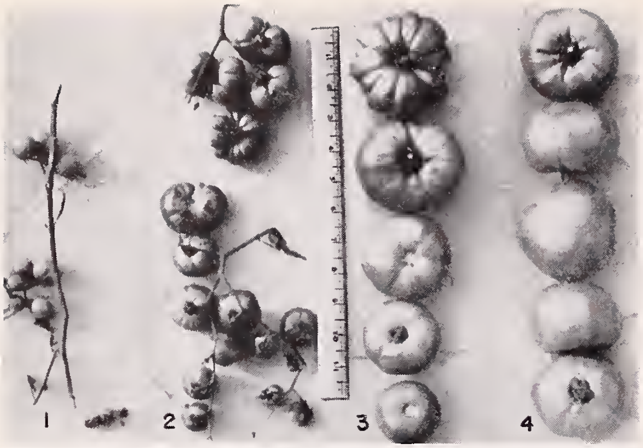

Development of the new "Turrialba" tomato from the cherry type: 1. Wild cherry type; 2. Wild parent type multiple-ovary form of number 1; 3. Other segregations; 4. "Turrialba."

ities, strong resistance to disease, and comparative freedom from puffiness have been inherited from this parent.

The new plant usually grows with a vigor, productivity, and stamina that are not apparent in other kinds. Furthermore, it has demonstrated better adaptability to acid soils of the Tropics than have the northern kinds. Throughout the course of our investigations these advantages have been unmistakable, especially during the difficult rainy season.

The fruit averages from 3 to 3½ inches in diameter. It is semi-globular in shape, firm-meated and bright red throughout, and has a moderately smooth, blemish-free skin. In appearance and flavor the variety is suggestive of Marglobe, though it is somewhat more oblate in form. Indications are that it has better resistance to disease, even to nailhead rust (*Alternaria solani,* (E. & M.) J. & G.), than have many other varieties.

Not Yet Perfect

That the new "Turrialba" has not been perfected is, of course, well understood. Segregations away from the type occur and may continue for several more plant generations. Since many of the more desirable characteristics, however, particularly those of the fruit, have been shown by our experiments to be of a recessive and moderately simple-factor nature, the fixing of a variety through the elimination of off-type characters should not require an undue length of time. In any event, the necessity of assuming a varietal name for a new plant already in commercial production is obvious, even though in a strictly technical sense it has not arrived at homozygous perfection. The details of its varietal status must follow at a later date.

The new "variety" is not yet ready for general distribution. Though with each generation the proportion of plants that deviate from our carefully established varietal pattern becomes consistently smaller, this percentage is yet above the margin for a typical commercial sort. In brief, the stress of war and the general need for increased food production have forced the "Turrialba" into a commercial use before it was fully developed. The variety will be perfected as rapidly as possible. When its characters are well established and thoroughly proved, seed will be made available to the public. Additional reports on the progress of the work will be given from time to time.

The new "Turrialba" tomato bears the name of the majestic volcano, 11,000 feet high, which almost overshadows the experimental fields of the Institute. From experiments in progress at this Inter-American center of research and instruction may emanate many other new and valuable agricultural accomplishments.

SUGAR INDUSTRY

(*Continued from page* 226)

brown sugar except that it is made into hard cakes. Many Brazilians, especially in the interior, carry pieces of *rapadura* with them to eat while they are working and prefer it to highly refined sugar.

The more modern mills are often *engenhos* remodeled. Steam is used for the boiling and some modern machinery has been added, such as vacuum pans and centrifugals. There are about 300 of these mills, 100 of which are equipped to produce more than 3,300 short tons of sugar a year.

Some of the mills do their own refining; others ship the raw sugar to refining centers near large city markets.

Economic Factors Affecting the Industry

Transportation is a major problem. Only a few of the larger and more modern mills have access to railroad facilities. Many of them must depend upon oxcarts to bring the cane from the fields. Of the finished product, approximately 75 percent is carried to the consumer by water.

Another problem is the surplus. The Northeastern sugar-producing States normally have a surplus of between 500,000 and 530,000 short tons of sugar of all types. In the South, Rio de Janeiro has a surplus of 100,000 to 130,000 short tons a year. These surplus-producing States normally supply the 400,000 to 430,000 short tons required by the large centers of population in São Paulo, the Federal District, Rio Grande do Sul, and Minas Gerais, with a surplus left of approximately 65,000 to 100,000 short tons. This must be diverted to alcohol production or exported.

Exports since World War I have been small. In recent years they have consisted largely of small shipments to Colombia, Peru, and Bolivia to meet the needs of people living east of the Andes, and to Uruguay and Argentina to offset crop shortages.

The Sugar and Alcohol Institute

To meet the problem of surplus production the Government, in 1933, created the Sugar and Alcohol Institute.

This official body succeeds the *Comissão de Defesa da Produção Acucareira,* created in 1931 to solve the sugar crisis that developed following the large 1928-29 crop. The Institute is composed of delegates from the Bank of Brazil, the Ministers of Finance, Labor, Agriculture, and Transportation, and representatives of the mills and the independent cane growers. Its purpose is to divert excess sugar to the manufacture of alcohol for use as motor fuel mixed with imported gasoline, but it also has authority to regulate the grinding and otherwise control sugar production.

Since the creation of the Institute, prices paid to the independent cane growers have been regulated, and research work and other cultural practices for the improvement of the economic conditions within the industry have been supported. Sugar production has increased 100 percent. Alcohol production has increased enormously, from 10,000,000 gallons in 1931-32 to 40,000,000 gallons in 1943-44. This expansion took place following a period when the sugar industry appeared to be ruined. Beginning with the 1944-45 season, production quotas have been removed from the next five crops in the belief that strong domestic demand for sugar and alcohol will absorb production.

At the present time the sugar industry is well off financially and many mills are making profits. No doubt, some of this prosperity will be invested in new modern equipment. As the industry modernizes, a decline in the number of the *engenho* mills is to be expected.

ECUADORAN AGRICULTURE

(*Continued from page* 232)

Belief is that three separate lines of activity must be followed, but they must be so integrated that they will supplement one another. First, in order to make modern agricultural technology available to Ecuadoran agriculturists, adult education seems necessary. Such education must be based upon the best possible knowledge of local institutions, Indian and Spanish customs, geographical location, local marketing conditions, and similar factors, so that the resulting active program will be acceptable to the various large and small agriculturists in the country.

Research would help Ecuador to develop new agricultural methods and techniques, to solve immediate local problems, and to carry on work in extension methods. The research needs to be on a wide range of problems, varying from plant insects and diseases to social and economic problems of the rural sector of the economy. Obviously the research and extension activities need to be closely coordinated, just as they are in the most effective land-grant institutions in the United States.

Finally, teaching and student training seem necessary. Because there is a dearth of professionally trained personnel at present, considerable activity in training is needed to provide the national personnel to carry on their part of the program.

The Cooperative Agricultural Experiment Station in Ecuador was established to work on these problems for those agricultural commodities which the United States is interested in importing, plus such related activities as are necessary to provide minimum support for the rural population of the areas in which the work is carried on.

Properly continued and developed, these suggestions provide the means for increasing both the speed and the extent to which modern agricultural practices will be introduced and adopted and for introducing new and profitable crops and varieties. As proved true in the United States, a period of trial is necessary before farmers are willing to turn to a research and educational institution for advice on farming practices, but such an institution offers real promise for permanently increasing the economic efficiency of Ecuadoran agriculture.

ALONG THE *Agricultural Front*

▲ Hydroelectric Project Planned for Brazil

A hydroelectric power project is planned for the Paulo Afonso Falls, on the São Francisco River, Brazil, that will be somewhat like the Tennessee Valley Authority in the United States. The proposed project will be under the direction of Brazil's Minister of Agriculture.

It will take about 5 years to complete the project, which should have an initial capacity of 110,000 kilowatts, and an additional capacity, up to 440,000 kilowatts total, to be provided as needed.

Current will be provided local consumers along lines similar to those established by the Tennessee Valley Authority. The present average wholesale price of 5 cents (U. S.) per kilowatt hour in this region is expected to be reduced to ½ cent per kilowatt hour.

The Paulo Afonso Falls are 140 miles from the mouth of the São Francisco River. The height of the Falls is 265 feet, and the annual mean volume of water is about 100,000 cubic feet per second.

▲ Agricultural Association Formed in Guatemala

An association known as the Guatemalan General Association of Agriculturists (*Asociación General de Agricultores*) has recently been approved in Guatemala and the modified statutes officially published. The association is to consist of coffee growers, sugarcane planters, cattlemen, and general agriculturists. Some of the objects of the organization are to promote the expansion and progress of agriculture and to defend the interests of the agriculturist and stock raisers; to develop investigation and scientific and practical knowledge of agriculture; to encourage national and regional expositions as well as ambulant expositions and lectures for the betterment and expansion of agriculture and livestock. The management of the association is to be entrusted to a Directive Board composed of 12 proprietary members and 12 substitutes appointed annually by a majority of votes in a general session of the members. The headquarters of the Association will be in Guatemala City.

▲ Cuba Encourages Handicraft Industry

The Cuban Government recently appropriated the equivalent of $50,000 which will be used to encourage commercial development of the handicraft fiber industry within that country. There is already some production of products such as baskets, bags, and fans from local vegetable fibers, but many believe that this production can be expanded for export.

The Ministry of Agriculture will be in charge of the program which includes the employment of a few skilled workers to instruct rural families in the art of handicraft manufacture. Materials and simple home machinery will be supplied by the Ministry, and offices will be established in rural areas where the finished products may be assembled for export.

▲ Argentine Agronomists To Meet Next Spring

The Third Argentine Meeting of Agronomy, sponsored by the Argentine Society of Agronomy, will be held next spring, from April 26 to 30 in Mendoza, capital city of the province of the same name.

The theme of the conference will be Intensification of Plant Introduction. There will be five major discussion groups: Plant Production, Animal Production, Crop and Livestock Industries, Crop and Livestock Production Economy, and History of American Agriculture.

Copies of the program, and regulations and rules of the conference may be obtained from the headquarters of the Secretariat, which has been established at the Argentine Scientific Society in Buenos Aires.

▲ Panama Plans Agricultural Census

The Government of Panama is planning an agricultural and livestock census, beginning this month in the Provinces of Herrera and Los Santos. The work will be carried on under the supervision of the Section of Agricultural Economy of the Ministry of Agriculture.

Considerable importance is attached to the Herrera and Los Santos census as these two provinces are important agricultural centers and the chief sources of supply for Colón and Panama City. The information gathered through this census also will provide an important part of the national census planned by Panama for 1950.

▲ Highway Named For President Roosevelt

The Congress of the Republic of Guatemala recently showed their admiration for the late President Roosevelt by passing a decree naming that part of the Pan American Highway which lies in Guatemala the Franklin Delano Roosevelt Road. The decree was passed at the Palace of the Congress on September 10.

▲ Fungus Corrodes Glass in Tropics

In tropical regions there is a fungus capable of corroding glass. This and the humid atmosphere, which favors corrosion of metals, make it necessary for scientific workers to protect their precision instruments. Any corrosion of microscope lenses by fungi would ruin the usefulness of valuable equipment.

A simple moisture-proof hood to protect such instruments has been devised at the Federal Experiment Station at Mayaguez, Puerto Rico. The hood is made from sheets of cellulose acetate film. Three light wire hoops are attached to the inside of the hood with adhesive tape. To get a moisture-proof seal, a small circular groove in the wooden base is filled with mercury. To dry the air under the hood, a small dish of calcium chloride is placed under the stand supporting the precision instrument. Such a hood is more convenient and less expensive than a glass bell jar, and the mercury seal improves the vapor-tightness.

SOUTHEASTERN BASIN

(*Continued from back cover*)

well wooded. Two other rivers empty into Lake Mirim. Río Tacuari, about 80 miles long, furnishes drainage for the greater part of the Department of Cerro Largo. Río Jaguarao forms the eastern boundary between Uruguay and Brazil, having its headwaters in the mountains of southern Brazil near the Uruguayan border.

On the eastern coast of Uruguay livestock farming predominates, although some crops are grown for local consumption. The people are not particularly fond of cultivating the land but prefer to raise cattle. In fact, the raising of livestock takes precedence over everything else in Uruguay except in the southern portion near Montevideo, which is the principal crop-producing area of the country.

Brazil's Part of the Basin

In the Brazilian portion of the Southeastern Drainage Basin a steep and rugged escarpment, or face of rocks, in some places as high as 2,500 feet, forms the western margin. It extends almost to the sea at two or three points. Because only a few rivers cut through these mountains, communication is difficult between the coast and the interior.

Between the Uruguayan boundary and the Jacuí River, on which Porto Alegre is located, the coastal lands widen out and enclose, near the coast, three lagoons or lakes, known as Lagoa dos Patos, Lagoa Mirim, and Lagoa Mangueira. Lagoa Mirim forms part of the boundary line between Uruguay and Brazil and furnishes a considerable area of navigable water. Lagoa dos Patos is an enlargement of the Jacuí River near its entrance into the Atlantic and is about 140 miles long and 40 miles wide. West of the lakes, the country is largely pastoral. There are a few agricultural settlements in scattered spots in the forest just west of Lagoa dos Patos, but the vast area of the prairie lands has never been seriously considered as farming country.

Rio Jacuí Basin is the largest and most populous of the drainage basins in eastern Rio Grande do Sul. In the floodlands of this river and of Rio Taquari, its northern tributary, lies a great rice-producing area which provides a large part of the food supply for the people of Porto Alegre. The system of land tenure in this district is the large estate with tenant workers. One of Brazil's chief tobacco-growing districts lies around the town of Santa Cruz. On the slopes of the hills a little to the north, hogs and corn predominate, with rye and potatoes also grown. Still higher in the hills are vineyards, from which between 75 and 90 percent of the grapes of Brazil are produced.

Porto Alegre is built on a ridge of hills on the left bank of the Jacuí River. It is situated near the junction of five waterways—Lagoa dos Patos, Rio Jacuí, and three tributaries. A large part of the traffic from the interior comes by boat through Porto Alegre. The city cannot, however, be reached by ocean steamers because the Lagoa dos Patos is too shallow to be navigated by any but shallow-draught boats. Two ports, Pelotas and Rio Grande, located near the outlet of the lake to the sea, compete for the transshipment of goods brought into and out of the State of Rio Grande do Sul.

North of Porto Alegre the Great Escarpment approaches the ocean, and for some distance the coastal plain is narrow and drained only by short rivers. Rio Itajaí Assú is the largest of these. The German farmers who settled in this basin grow corn and manioc to feed hogs and dairy cattle, whereas the Italian farmers grow rice and tobacco in the valley and have vineyards on the slopes of the hills. Farming is predominantly a corn-hog combination. Banana plantations, however, are situated along the coast from the State of Santa Catarina throughout the northern part of the Basin.

Along the coast of the State of São Paulo the most important river is the Ribeira, which is navigable for some distance. It brings down from the eroded mountains soil which has formed a narrow alluvial lowland. Along the ocean, beaches of white sand are backed by mangrove-filled lagoons. The tropical climate favors the cultivation of bananas, palms, vanilla, and, most important of all, rice. Along the coast and on the rainy slopes of the Escarpment there is a dense tropical rain forest composed of broadleaf evergreen species.

Santos, the third-most-important city of Brazil, is situated in the northern part of the Basin. It is 3 miles from the open sea and is approached through the winding Guaruja Channel. It is connected by rail and highway with the city of São Paulo, 50 miles away, and is the outlet for a large sugar, cotton, and coffee area in the interior. About half of Brazil's exports leave by way of Santos. The tremendous volume of merchandise handled at this port makes the São Paulo railroad highly profitable.

Above Santos, the Great Escarpment comes still closer to the sea, leaving only a narrow slope drained by short torrents.

The rivers of the Southeastern Drainage Basin of Uruguay and Brazil are not in themselves of great agricultural or commercial importance. The ports along the coast in this area, however, provide an outlet for products from some of the richest agricultural regions of South America.

MARABU

(*Continued from page* 229)

cultivation to control newly formed shoots of *marabú* is necessary until the cane reaches sufficient size to shade out the *marabú*. The cost of slashing and burning, under favorable conditions for the latter, was reported to have amounted to $3,000 for a *caballería*, which is about 33.33 acres, several years ago when wage rates were lower than they are now. More densely infested areas, where burning was not complete, were reported to have cost $6,000 per *caballería* to put the land in condition for agricultural use.

Growing concern in regard to the problems created by *marabú* recently prompted the Cuban Government to ask aid of the U. S. Department of Agriculture in combatting this pest. A careful study of methods of eradication and control, including the use of chemicals, should lead to the discovery of a practical means of controlling *marabú*.

The Violent Land, by Jorge Amado, translated by Samuel Putnam from the Portuguese *Terras do sem fim.* 335 pp. Alfred A. Knopf, New York, 1945. "In the opening up of southern Bahia, Brazil experienced a 'cacao-rush' that more than matched California's gold rush in drama, tragedy, and brawling humor. That pell-mell drive to be first to harvest gold from the unbelievably fertile cacao-producing lands was taken by Jorge Amado—an outstanding novelist of Brazil's active literary world—as the background for his famous novel, *Terras do sem fim.*" This is the English translation of that book.

What the South Americans Think of Us. 400 pp. Robert M. McBride & Company, New York, 1945. This is a symposium by four authors who have long been students of South America and have held important positions in international relationships. Carleton Beals writes for Ecuador, Peru, and Bolivia; Bryce Oliver, for Brazil and Uruguay; Herschel Brickell, for Venezuela and Colombia; and Samuel Guy Inman, for Argentina and Chile. The question under discussion is, as the title implies, the outlook for future relationships between South America and the United States. Included in the discussions are the stories of Bolivian tin, Chilean nitrates and copper, Argentine beef, and activities of North American businessmen and ambassadors of good will in South America.

Canada and the World Tomorrow, edited by Violet Anderson. 159 pp. The Ryerson Press, Toronto, Canada, 1944. The addresses given at the Canadian Institute on Public Affairs in August 1944 have been collected in this volume. One section deals with international affairs, such as problems in the Far East, the Bretton Woods proposals, and cartel policies; the other, with Canadian postwar affairs. Questions for study groups and suggestions for further reading on the subject of each address are given.

New Found World, by Katherine B. Shippen. 262 pp., maps and illustrations. The Viking Press, New York, 1945. This is a book for younger readers interested in South America, "not a book just about rubber and petroleum and Panama hats that are made in Ecuador, but one about the people, both Indians and Spaniards, how they came to be there and what their ideas are." Black-and-white drawings by C. B. Falls, with descriptive captions, at the beginning of each chapter, and a detailed bibliography and index add to the charm and value of the book.

South America Uncensored, by Roland Hall Sharp. 363 pp., illus. Longmans, Green and Company, New York, 1945. This book is an account of the experiences of a staff correspondent on Latin-American affairs for the *Christian Science Monitor,* who traveled 110,000 miles in South America during the past 7 or 8 years. In the first two sections the author discusses South American politics and the Good Neighbor Policy as he believes them to be; in the other two sections he gives a pen picture of the country, its resources and handicaps, and the possibilities of various sections as frontiers in economic fields.

Green Cargoes, by Anne Dorrance. 187 pp. Doubleday, Doran & Co., New York, 1945. The term "green cargoes" is used to connote the collection, transportation, and use of plants in regions other than their native habitats, and their reactions under new conditions. In narrative form the author tells of the many green cargoes which have sailed between the Old and New World. The discovery of the idea of the wardian case for the transportation of living plants is included in the story.

Pan American Business Spanish, by Terrell Louise Tatum. 255 pp., illus. D. Appleton-Century Company, New York, 1945. This recent addition to the Century Modern Language Series presents fundamentals of up-to-date Spanish-American commercial correspondence, with a background panorama of Latin America as a whole. It is designed for students who have covered an introductory grammar course and wish to apply their knowledge. Actual letters from the files of large business houses have been used for illustration. An appendix containing English equivalents for Spanish abbreviations and names, together with a two-way vocabulary, adds to the value of the book.

Brazil-1943. 630 pp., illus. Ministry of Foreign Affairs, Rio de Janeiro, 1944. This is an English translation of the latest edition of *Brazil.* In it are presented in detail, with tables, charts, and colored illustrations, the present economic situation and resources of Brazil.

EDITOR'S NOTE.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

AGRICULTURE IN THE AMERICAS — O. R. CARRINGTON, EDITOR

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Gifts of the Americas

THE BRAZIL NUT

by WALTER R. SCHREIBER

Among the contributions made by Brazil to the field of international trade is the Brazil nut, known in that country as *castanha de pará* (chestnut of Pará).

The Brazil-nut tree, *Bertholletia excelsa*, is the tallest and perhaps the most impressive tree in the Amazon Basin, often towering 150 feet or more. The trunk is perfectly straight for most of its length and free of branches until the spreading crown is reached. Brazil-nut trees are scattered all through the vast expanse of the Amazon Basin, but, since they grow wild and plantations have thus far proved unsuccessful, no one can give a reliable estimate of their total number. They are usually found in groups of six or more, growing on well-drained ground.

The fruit of the tree is a large pod, hard and fibrous, called *ourico*, from 4 to 6 inches in diameter. Inside this pod, clustered closely together, are from 12 to 20 dark brown nuts known in the United States as Brazil nuts. The nuts are irregular in shape but roughly resemble the segments of an orange.

The flowers grow on the small outer branches in cream or white clusters, resembling the ornamental hydrangea of the United States. A point of interest is that the blossoms appear approximately a year in advance of the harvest. The quantity of blossoms on the trees in a current season, therefore, gives a preliminary indication of the potential yield a year hence.

Such a preliminary indication on a commercial plantation of fruits or nuts would normally be of great help in forecasting production. In the case of Brazil nuts, however, which grow almost entirely wild, it is only a partial forecast because of a great many unpredictable factors. The vastness of the area in which Brazil-nut trees are found naturally means a variety of weather conditions, although, since the Amazon Basin is in the Tropics, no frost damage ever occurs. The amount of water in the streams, storms during the blossoming and pollination period, or severe windstorms causing premature fall of fruit all make losses inevitable in some parts of the region each year, but the total production over a period of years is not materially affected by weather losses. Economic factors are far more important, chiefly the availability of labor and the prices offered by trading posts to native gatherers of the nuts.

The importance of these nuts to the general economic life in the Basin is great. The value of Brazil-nut exports is generally second only to that of rubber exports. Since 1942, nuts have not been collected in as large numbers as usual because labor has been diverted to rubber collection, considered more important to the war effort. Export trade in Brazil nuts dates back to about 1633, when traders from the Netherlands carried nuts back as "wild oil fruits." Up to 1818 exports were from Maranhão. In that year the first shipments were made from Pará, and the bulk of the trade has been from Pará ever since.

Prior to 1914 German and English traders carried unshelled nuts from Belém and Manaus to Europe, shelled them, and sent them back to Rio de Janeiro and other destinations including the United States. After World War I, a shelling industry was established in Brazil and grew rapidly. American importers began to import both shelled and unshelled nuts directly from that country. As a result, the collection of Brazil nuts increased tremendously. In 1911 only 8,600 short tons were gathered, but by 1935 this figure had risen to 50,600 tons.

The Brazil nut is well known to most North Americans, as it almost invariably turned up at Christmas time in nut mixtures, before importation was stopped because of the war. Taste for the nut was increasing, both for nuts in the shell and shelled nuts for candy. Outside of Rio de Janeiro and São Paulo, however, few Brazil nuts were consumed in Brazil, and many Brazilians hardly knew they existed, prior to the present war. The Amazon is a great many miles from Southern Brazil, and transportation was difficult.

In 1939, only a few hundred tons were consumed in all of South America. The United States bought more than half the annual output and the United Kingdom and other European countries took most of the balance. Brazil has virtually a monopoly on these nuts. The quantity produced in other countries having access to the Amazon Basin is small, and attempts to grow them abroad have been failures.

The oil content of the nut is high, averaging from 65 to 70 percent. Its food value is also high, analysis showing that only 14 grams of Brazil-nut kernels are required to produce 100 calories. Perhaps when the rubber situation eases, Brazil nuts can help supply the deficiency of fats and oils in Europe.

SOUTHEASTERN DRAINAGE BASIN OF URUGUAY AND BRAZIL

by **Ruth Parker Schottroff**

The Southeastern Drainage Basin of Uruguay and Brazil covers a narrow strip of coastal land extending from the Río de La Plata in Uruguay north to a little above Santos, Brazil. On the western edge of the Basin is the Serra do Mar, a range of mountains lying near the Atlantic Coast of Brazil and terminating in low mountains and foothills called the Cuchilla Grande in southern Uruguay. So close to the coast are these mountains that only short rivers flow eastward to the sea. Some streams rising within 20 miles of the Atlantic flow westward to the Paraná or to the Uruguay River Basins.

The climate varies from temperate in Uruguay to sub-tropical in southern Brazil, and then to humid tropical heat on the coast of São Paulo. There is an abundance of rainfall, well distributed throughout the year in southern Brazil and averaging from 60 to 130 inches annually. In Montevideo the average is about 38 inches, but the annual average varied from 21.6 inches in 1907 to 94 inches in 1914.

The population, which consists mostly of people of European origin, is well distributed throughout the Basin. The centers of population are three cities: Montevideo, with about 703,900 people, Porto Alegre, with 280,800, and Santos, with 148,800. All are important ports furnishing outlet to the sea from rich agricultural areas in the interior.

Uruguay's Part of the Basin

The southern part of this Southeastern Drainage Basin, in southern Uruguay, is drained by several small rivers flowing into the great estuary of the Río de La Plata. The Santa Lucía, which flows for about 94 miles before it empties into the La Plata, is the largest of these small rivers and furnishes the water supply for Montevideo. The San José, principal tributary of the Santa Lucía, is about the same length.

Approximately 586,000 acres of wheat, 330,000 acres of corn, and 207,000 acres of flax are planted in the region around Montevideo, as well as other small grains and vegetables. Many varieties of fruits, too, suitable to temperate climates are grown here, with grapes for wine predominating. Almost all of Uruguay's vineyards are located in the Departments of Montevideo and Canelones, with a yearly production of about 100,000 tons of grapes. Livestock raising is carried on throughout the area, and a considerable amount of dairying is conducted near Montevideo.

Montevideo, the capital of the country, is built on a chain of hills sloping gently to a partly protected bay on the Río de La Plata. From these hills it commands a delightful view of the bay and the river. The city contains about one-third of the total population of Uruguay. It is favorably situated for ocean commerce in that it lies near the outer end of the La Plata estuary and is equipped with excellent port facilities. Besides being a world port, it is a railroad and industrial center. It has modern buildings and is a favorite summer resort for both Uruguayans and Argentineans.

The eastern portion of Uruguay becomes more undulating. Its surface is composed of successive low mountain or hill ranges known as the Cuchilla Grande, between which lie green and fertile plains. The formation of many of the hills is calcareous, and fine marble and excellent limestone are obtained from them.

The valley of the Cebollati River, which flows for a distance of 95 miles into Lake Mirim, is one of the richest and most fertile regions of the country. It is drained by several small streams, and the mountains near it are

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NAMES & NEWS

Allee Returns From Extended Tour

Ralph H. Allee, Assistant Chief, Technical Collaboration Branch, Office of Foreign Agricultural Relations, returned to Washington in November after an extended trip through Colombia, Nicaragua, El Salvador, Guatemala, Panama, and the Canal Zone, where he visited a number of cooperative agricultural experiment stations. Mr. Allee also attended the First Conference of the United Nations Food and Agriculture Organization in Quebec.

•

Dr. Martín Cárdenas Visits United States

Dr. Martín Cárdenas, Rector of the University of Cochabamba, in Bolivia, came to the United States recently, as a guest of the Department of State, to confer with agricultural experts on plant breeding techniques, with special reference to the potato and Indian corn. He spent several weeks observing work in plant exploration and introduction at the Beltsville Research Center, later visiting the Botanical Museum and Gray Herbarium at Harvard University and a number of experiment stations in eastern and western States.

•

USDA Representatives Attend Mexican Conference

Leslie A. Wheeler, Director, and *John A. Hopkins,* Agricultural Economist, Office of Foreign Agricultural Relations, together with *Phillip V. Cardon,* Administrator, Agricultural Research Administration, attended the meetings of the Mexican-United States Agricultural Commission, held in Mexico City in December. The general objective of this Commission is to promote the development of agriculture in Mexico and the United States along lines mutually advantageous to both countries. Mr. Wheeler served as Chairman of the United States Section and Co-Chairman of the Commission.

Hambleton Assigned To Peru and Ecuador

Edson J. Hambleton, Entomologist for the Office of Foreign Agricultural Relations, has been assigned to special work at the Cooperative Agricultural Experiment Stations in Peru and Ecuador. One of the purposes of Mr. Hambleton's trip will be to conduct tests with DDT for control of malaria.

•

Percy N. Annand Returns From Mexico

Percy N. Annand, Chief of the Bureau of Entomology and Plant Quarantine, USDA, has returned from a trip to Mexico, where he consulted with Mexican officials on problems of mutual interest connected with the control work of fruitflies and the pink bollworm of cotton. This work is conducted on a cooperative basis by the Mexican Department of Agriculture and the United States Bureau of Entomology and Plant Quarantine. Dr. Annand also reviewed the work under way at the Entomology and Plant Quarantine Station in Mexico City and consulted with Ing. Darío L. Arrieta on matters pertaining to the Mexican-United States Agricultural Commission.

•

Claud Horn Attends Iowa State Conference

Claud L. Horn, Complementary Crops Division, Office of Foreign Agricultural Relations, recently represented the United States Department of Agriculture at a conference at Iowa State College. The conference was called for the purpose of conferring with workers on the corn-breeding and selection experiments which the College is conducting in Guatemala and of discussing plans for the Tropical Research Center to be inaugurated in July 1946 in the city of Antigua, Guatemala. Others attending the conference included Charles E. Friley, President, and I. E. Melhus, Head of the Department of Botany, Iowa State College; Héctor Lazos, Agricultural Attaché from the Mexican Embassy in Washington; Alfonso González Gallardo, Mexican Sub-Secretary of Agriculture; and Ernesto Viteri, representing the Guatemalan Ministry of Agriculture and the Carrette Corporation.

For details about the Center *see* page 16.

Agriculture IN THE Americas

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Quebec Conference Launches FAO

In the Canadian city of Quebec, late in October, the plan for a United Nations Food and Agriculture Organization was realized. Forty-two nations have become members of FAO.

by GOVE HAMBIDGE
and PAUL L. YATES

The United Nations Food and Agriculture Organization (FAO) has now come into existence. Representatives of the United Nations met in Quebec, Canada, from October 16 to November 1 to sign the Constitution of the new Organization and to hold the First Session of its Conference. Before the Session ended, a total of 42 nations had joined, including 17 Latin American Republics: Bolivia, Brazil, Chile, Colombia, Cuba, Dominican Republic, Ecuador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela.

Purpose of FAO

FAO is the first of the new permanent United Nations agencies to be established and to start work. Its field of activity is food, agriculture, forestry, and fisheries. It is concerned with the production and consumption of the products of the soil and the sea. Its inspiration derives from a few simple assumptions: People could and should be eating more of the foods needed for health; a consequent large increase in food output could and should be forthcoming all over the world; and farm people could and should have better living standards. International action by governments working together through FAO can quicken progress toward these ends.

The idea of a close union between the nutritional or food needs of people and agricultural production was first proposed at Geneva as far back as 1935. Freedom from want was proclaimed in the Atlantic Charter of 1941. The two ideas were combined in the Hot Springs Conference of the United Nations called by President Roosevelt in 1943. From then on, an Interim Commission was at work drafting the Constitution and outlining the scope and functions of a permanent food and agriculture organization. On the day Japan surrendered, the Commission issued invitations to the Quebec Conference.

No time could be better than the present for starting FAO. World War II has left much dislocation and many difficulties. In Europe there is the gigantic task of providing food and shelter for millions of suffering people. Here in the Americas there is uncertainty about how much of the war-expanded production will be wanted under normal conditions. The war has created a great opportunity to take advantage of the break in mental, as well as in economic, processes and to build new institutions which will bring more lasting and more practical programs for prosperity and peace. As one delegate at Quebec said: "The armed forces have ceased to fight; but now a new army is appearing, an army of technicians, agriculturists, scientists, laborers, which is commencing a fight against disorganization, a fight against poverty, a fight against famine, uncertainty, and evil."

FAO is an intergovernmental agency consisting of a Director General and a staff of experts. Its controlling body is the annual Conference, each nation having 1 vote, and between sessions an Executive Committee of 15 persons. Its temporary seat is at

Mr. Hambidge recently became the Director of Information Service for the United Nations Food and Agriculture Organization. Prior to this he served as Coordinator of the Agricultural Research Administration for the United States Department of Agriculture.

Mr. Yates is an Economist on the staff of FAO. For many years he served with the British Government in the Ministry of Economic Warfare, Ministry of Agriculture, and Ministry of Food.

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National Film Board Photo

Sir John Boyd Orr, amed Scots nutritionist, scholar, and farmer, was elected unanimously to the post of Director General of the United Nations Food and Agriculture Organization.

Washington, but the ultimate seat will be at the headquarters of the United Nations.

Business of the Conference

The work of this first Conference was carried out by two Commissions, each divided into a number of committees.

Commission A, which was concerned with policy and program, submitted some 300 recommendations dealing with a wide range of subjects under the broad headings of nutrition and food management, agriculture, forestry and forest products, fisheries, marketing, and statistics. These recommendations were accepted by the Conference and commended to the Director General and to Member Governments for their earnest attention. With so large a number of suggestions for its future work, FAO will be faced immediately with the task of deciding what should be given priority for urgent action. The organization will be small in the beginning and it will need to assemble a competent staff as its work develops.

It may be said concerning the recommendations of Commission A that they probably represent as comprehensive a summing up of the problems that face world agriculture, forestry, and fisheries, and of the best thinking of experts of many countries regarding

National Film Board Photo

The United Nations Food and Agriculture Organization Conference was held in the ballroom of the Chateau Frontenac. Delegation chairmen sit at the long lines of tables down the center of the room, with the members of their respective delegations immediately behind them.

National Film Board Photo

High above the St. Lawrence River stands the Chateau Frontenac, a world-famous landmark in the historical city of Quebec. Here the representatives of 42 nations signed the Constitution of FAO.

possible solutions, as can be found anywhere.

Commission B, concerned with organization and procedure, submitted a number of formal recommendations, which were adopted by the Conference. These included rules of procedure and financial regulations for FAO; tentative budgets for the first 2 years; provisions for cooperative relations between FAO and other United Nations organizations; provisions for the winding up of the affairs of the International Institute of Agriculture and the transfer of its property and functions to FAO; similar provisions regarding the *Comité International du Bois;* and authority for the Director General, with the approval of the Executive Committee, to establish provisional regional offices in the near future.

The Quebec Conference chose an Executive Committee, of which four Americans are members: Newton Castro Belleza of Brazil, Edouard Baker of Haiti, Alfonso González Gallardo of Mexico, and Howard R. Tolley of the United States (Vice Chairman). It chose as FAO's first Director General Sir John Boyd Orr, a Scotsman and a practicing farmer who has a world-wide reputation for research work in nutrition and agriculture and has particularly championed the FAO idea of linking agriculture to health through nutrition.

What FAO Can Do

Consider the food on an ordinary family's table. In many lands admittedly it is unhealthful and monotonous, consisting of too much cereal and not enough dairy products and vitamin-rich foods. Is there a connection between these deficiencies and the deliberations of a United Nations agency 3,000 or more miles away? Yes, just as there is connection between the warmth of the waters of northern Norway and the currents which eddy around the Caribbean Sea. For example, during the war certain countries that were short of food found ways of achieving surprising nutritional improvements both by getting people to produce nutritionally valuable foodstuffs in their own back gardens and by allocating important foods such as milk and eggs to make sure that those who need them most, the mothers and young children, would be adequately fed. Not many other countries have heard of these programs or have thought how to develop similar programs in their own countries. FAO could provide the information and arrange, if desired, for experts to visit an inquiring country and advise on how to establish better methods of food distribution.

Through FAO, governments will be able to obtain the services of the world's best experts on agricultural

(Continued on page 15)

Brazil's Oil-Yielding Palms

Brazil is a land of palms, palms of many different kinds and serving various purposes. The oil obtained from the fruit of these trees is helping to meet Brazil's need for vegetable oils.

by MIRIAM L. BOMHARD

Brazil has more kinds of palm trees than any other country in the world. Nearly 500 species out of a total of perhaps 1,250 palms indigenous to the Americas occur in Brazil. Many of them are oil-yielding palms and, in addition to being beautiful, are helping to furnish the vegetable oils which Brazil and other nations of this Hemisphere need.

The varied topography and climate of so vast a country as Brazil, lying mainly within the Tropics, can naturally support a great variety of palms. There are palms growing on wet and on dry land, in fields, thickets, and in woods, palms that prefer low-lying areas as well as those on hills and higher elevations, and palms bordering watercourses and fringing seashores. Many occur scatteringly, but some species exist in such dense groups that they constitute a notable exception to the general observation that tropical trees almost never grow in pure stands.

Industrial Importance

Industrial utilization of some of Brazil's oil-yielding palms was initiated about the time of the First World War. When World War II began, babassú kernels had not only come to occupy a prominent place in internal commerce but were being shipped abroad in relatively large quantities. The exploitation of certain other oil-yielders was also well advanced. The securing of palm oils in large quantities within the Western Hemisphere suddenly became important, as the usual supplies of coconut oil and copra, from the coconut palm, and palm kernel oil and palm oil, which come from the African oilpalm, were no longer obtainable from the Far East and West Africa.

Brazil has rich resources of palm oils. At present, babassú, licuri (also called ouricury), tucum, and murúmurú are the most important native oil-yielders. Bacába, patauá, macaúba and mucajá, burity and murity, and jupaty are being used in lesser degree. The numerous coconut and African oilpalms, which have long been growing in Brazil, are also supplying palm oils, but not to the fullest possible extent nor do they as yet equal the importance of some of the strictly native species.

Oil is obtained from the fruits of palms. The endosperm of the seed or seeds, usually enclosed in a nut, furnishes kernel or nut oil. The mesocarp, or fruit

Courtesy of A. A. Bitancourt

Macaúba palms are common in certain parts of Minas Gerais, where they may be seen growing in cultivated areas as well as in wild stands. This picture shows macaúba palms growing in cornfields in the rolling country north of Belo Horizonte.

flesh, gives pulp or pericarp oil. Fruits of some palm species have both kernel and pulp oils in sufficient amount to be economically valuable, but others yield only one kind. The first palm pulp oil to enter trade channels was that of the African oilpalm, which is even today known simply as "palm oil"; "palm kernel oil" refers to the seed oil of this same palm.

The various palm kernel oils are, on the whole, so similar chemically that they are classed together as the coconut series of kernel oils, remarkable for their high lauric acid content and high saponification, or soap-making, values. They can, with certain exceptions, be substituted for each other and used for most of the same purposes for which coconut oil and palm kernel oil serve. Pulp oils are different. Some share the characteristics of palm oil; others resemble olive oil. Thus far, Brazil's palm kernel-oil resources have been developed far more than those of the pulp oils.

Some Uses

One of the principal uses of palm oils is in the manufacture of soap. The high saponification value of the kernel oils accounts for the excellent lathering properties of the soaps that contain them. Coconut oil has long been considered an essential ingredient for shampoos and other liquid soaps as well as for soaps that must be used in cold or salt water. In 1941 the United States consumed almost one-half billion pounds of coconut oil and one-fourth as much palm oil in the making of soap. Palm kernel oil and babassú oil were used in lesser amount. The United States has to import its palm oils, but Brazil has the advantage of its own supply for soap manufacture.

Glycerine, a basic material for explosives, and used for certain medicines and in various industries, is mainly obtained from the soap lye that remains after the making of soap. Palm kernel oils yield from 12 to 14 percent glycerine, a somewhat higher percentage than is secured from other vegetable or animal fats.

Another important use of the palm kernel oils is in edible products. Their high nutrient quality makes them excellent substitutes for animal fats. Palm oils are being increasingly used in some tropical countries for vegetable butters and oleomargarine. Bakers employ them for various purposes, and candy manufacturers use them in many kinds of candy bars, chocolate cream candies, and for roasting nuts.

Dr. Bomhard, an Ecologist in the United States Forest Service, has traveled widely and is nationally recognized as an authority on palms. She is author of the list of palm genera in *Standardized Plant Names.*

Courtesy of Chicago Natural History Museum

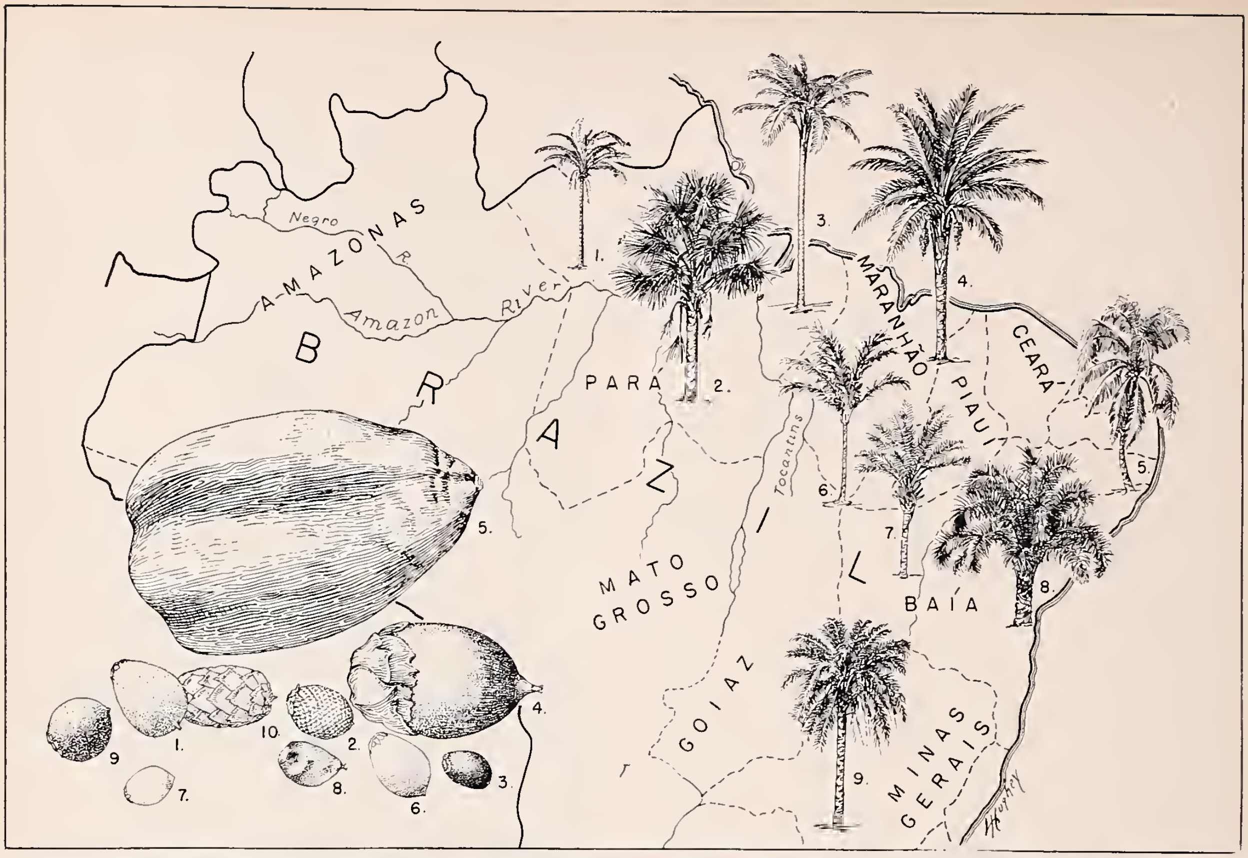
A magnificent specimen of a babassú palm, with a heavy crop of fruits, towers above surrounding trees.

Some of the palm oils constitute excellent fuel for internal combustion engines; some serve as lubricants. The press cakes that remain after most of the oil has been expressed are used for livestock feed, fertilizer, and a steam-boiler fuel. The pulp oil of the African oilpalm plays an important role in the manufacture of tin and terne plate. Some shaving creams, dentrifices, and cosmetics contain palm oils.

Babassú, Licuri, and Spiny Palms

Babassú palms are the foremost palm-kernel producers in Brazil. These handsome trees, often 60 feet in height, have a vase-shaped crown of leaves that are at least 25 feet long. Mature palms annually produce from 2 to 8 enormous fruit bunches, each weighing as much as 200 pounds. The egg-shaped or oblong fruits, tipped by a beak, average from 4 to 6 inches in length and from 2 to 3 inches in width.

To pick up mature fruits fallen to the ground is easy but cracking them to obtain the kernels presents a problem. Various machines have been invented to split the nut, which is extremely hard and is separated



Examples of Brazilian oil-yielding palms in the general locations where they grow. Their fruits, about one-fifth natural size, appear in the lower left-hand corner of the drawing. 1. Murúmurú, 2. Burity, 3. Patauá, 4. Babassú, 5. Coconut, 6. Tucum, 7. Licuri, 8. Dendê, 9. Macaúba, 10. Jupaty (fruit only).

by a thin mealy layer from the dense fibrous husk. Most machines, however, injure the kernels, which lie in cavities within the nut wall. The development of a thoroughly satisfactory machine would do much to put babassú kernel production on a steady and predictable basis. Until such a machine is developed, reliance must still be placed upon painstaking hand-cracking, with an axe, by countless laborers.

Babassú palms occur naturally in such abundance, numbered in billions of individual trees, and their range covers so wide an area that the possible kernel yield if all the palms were exploited is enormous. Today, Maranhão and Piauí, and recently Minas Gerais, are the principal production centers, but the palms also extend westward into the Upper Amazon region.

Several species, at least *Orbignya oleifera* Burret and *O. martiana* Barb. Rodr., are undoubtedly involved in the present babassú kernel production. Kernels of several *Attalea* species have long been intermixed with those of babassú. In fact, a large number of palms rather closely related to babassú represent an enormous potential reservoir of palm oils awaiting exploitation.

The licuri palm, also called ouricury, occurs on relatively poor dry soil, from Pernambuco to Minas Gerais, particularly in Baía. These palms grow about 30 feet tall, and the trunk averages 8 inches in diameter. The gray-green leaves, about 10 feet long, have a characteristic spiral arrangement noticeable when only the leaf bases remain clinging to the trunk. The thin-skinned ovoid, yellowish fruits, 1¼ inches long, have a fibrous-fleshy pulp surrounding the nut. Each nut contains one seed. The kernels were first used commercially about 1915 but now occupy an important place as a source of kernel oil.

Leaves of this species have come to be recognized within the past decade as a valuable source of palm wax. Although somewhat different in chemical properties, licuri wax now augments supplies of palm wax formerly obtained solely from the Brazilian carnaúba palm.

Licuri is so closely related to the coconut palm that some investigators maintain the name *Cocos coronata* Mart. rather than *Syagrus coronata* (Mart.) Becc., the correct designation in the opinion of those who believe that the coconut palm stands alone in the genus *Cocos*.

Tucum and murúmurú palms represent different species of the same genus, *Astrocaryum*, whose members usually have spines on the trunk, leaves, and fruit clusters, and whose nuts ordinarily contain a single seed. *Astrocaryum* literally means star nut, in allusion to the three asterisk-like eyes, or germ-pores, of the nut, each of which is surrounded by radiating lines.

The tucum kernels utilized in and exported from northeastern Brazil, especially Piauí, come principally from a medium-sized tree, *A. vulgare* Mart. This tree occurs in various habitats, sometimes intermixed with babassú palms, from Baía and Ceará to Pará and into British Guiana and Venezuela. A good quality of pulp oil, used locally for the most part, is obtained from the sweet edible fruit flesh. Many other species of tucum palms occur in various parts of Brazil. The leaves of some species furnish valuable fibers.

The murúmurú palm, *A. murumuru* Mart., with eaves silvery white on the under surface, is one of the handsomest palms in the Amazon Valley. It grows usually on low-lying islands and river banks subject to periodic overflow. Murúmurú has been the outstanding source of palm kernels in Pará, the oil being especially suitable for edible purposes, but it does not yield pulp oil. Mechanical breaking of the nuts has been eminently satisfactory for murúmurú.

Acrocomia is another spiny palm group. It is widespread in both tropical and temperate climates of the West Indies, Mexico, and Central and South America. The mucajá palm of Pará and the macaúba palms of southeastern Brazil are important Brazilian representatives of this genus and offer an especially promising native source of pulp oils. Commercial exploitation of these palm fruits for both their kernel and pulp oils is relatively recent. The main center of activity is Minas Gerais, where macaúba palms are plentiful. The nearly globular fruits, measuring about 1½ inches in diameter, have an edible and aromatic, but stringy, oily, mucilaginous pulp. The spherical nut within the pulp contains a single seed. Cattle eat the fruits but naturally derive no benefit from the nuts.

Not Strictly Native

That neither the coconut palm nor the African oilpalm is native to the Western Hemisphere is now rather generally conceded. Both grow in Brazil in larger numbers than anywhere else in the Americas, and many individual trees give the appearance of being wild. Both are also being reared on a plantation basis, especially in Baía.

Coconut palms, *Cocos nucifera* L., occur from Pará nearly to São Paulo, somewhat inland as well as on the coast. Although the annual fruit yield of the so-called *nativos*, or uncultivated, trees is not high, the *coco anão*, a type of dwarf coconut that was introduced into Baía from the East Indies in 1925, has borne from 300 to 400 coconuts per tree annually on experimental plantations. Practically the entire production of copra and coconut oil is consumed within Brazil itself, and the milk and meat of the fresh coconuts are held in great esteem.

The African oilpalm, *Elaeis guineensis* Jacq., so well known in world trade for its palm kernel oil as well as for its palm oil, grows subspontaneously in Brazil from Amazonas to Baía. Brazilians call it *dendê*. In Baía, where great progress has been made in the planting of systematic *dendê* plantations, the number of these palms is estimated at a million and a half, and *dendê* kernels have from time to time entered into export trade. *Dendê* palms average 50 feet in height,

(*Continued on page 14*)

Courtesy of E. P. Killip

Characteristic habitat of the murity palm is along the banks of streams. The fan shape of the huge leaves is not apparent because the blades fold together with sides drooping.

Courtesy of Jason R. Swallen

Tucumá palms on Marajó Island at the mouth of the Amazon River.

Agricultural Collaboration In Nicaragua

Under agreements entered into by the United States, cooperative experiment stations have been established in Ecuador, Peru, El Salvador, Nicaragua, and Guatemala. This is an account of the work being carried on at the Nicaraguan Station.

by ROBERT C. MONCURE

Although the Nicaraguan banana industry suffered heavily from disease before the war, leaders look to the country's agricultural future with optimism because of certain factors which they feel will give their country an advantageous position during the postwar period. These factors are nearness to United States markets, good river- and ocean-transportation facilities, a tropical trade-wind climate, a large residual population remaining from banana-plantation days, and areas of fertile agricultural soils.

A definite program for general agricultural improvement and the introduction of new crops is being developed through the Agricultural Experiment Station which is located at El Recreo with a substation at Cukra Hill. The Station was established through a Memorandum of Understanding between the United States and Nicaragua in 1942 and is similar to four others which have been established on a cooperative basis in Ecuador, El Salvador, Peru, and Guatemala.

Purpose for Establishment

The purpose of the Nicaraguan Station is to stimulate the production of tropical crops complementary to United States agricultural production. To do this successfully involves the introduction of agricultural research and extension methods to interest farmers in growing these products once the feasibility of their production has been established; improvement of living standards for the farmer and his family; training of local technical and nontechnical employees of the Station; and cooperation with other agricultural, public-health, and colonization agencies. Under the Memorandum of Understanding Nicaragua furnishes land, buildings, funds for operating expenses, equipment and supplies available within the country, laborers, mechanics, and associate technologists. The United States Government provides certain scientific equipment not available in Nicaragua, personnel for technical direction and assistance, and various United States scientific publications.

A typical farm along the upper Escondido River produces corn, rice, beans, and cattle.

Location of El Recreo

El Recreo is located on a tributary of the Escondido River at the head of motorboat transportation and 65 miles inland from Bluefields, the principal port of eastern Nicaragua. High humidity and abundant rainfall prevail throughout the year. The new highway, now under construction from Managua, will pass through the grounds of the Experiment Station. It will have its eastern terminus at the village of Rama, a few miles downstream from the Station and a former port of call for banana-carrying vessels.

The country around El Recreo and Rama is gently rolling, traversed by small streams, and with occasional outcropping of rocks. The general elevation is from 25 to 100 feet above the level of the river. Before the inroads of the deadly Panama and Sigatoka diseases the area was heavily planted in bananas, which

The author is an Agriculturist in the Technical Collaboration Branch of the Office of Foreign Agricultural Relations. He recently returned from a visit to El Recreo and Cukra Hill.

were transported by flatboat and canoe to Rama for loading on ocean vessels. Today, except for small subsistence crops and pasture for cattle for the Bluefields market, most of the area has reverted to forest.

Cultivated lands below Rama are limited to narrow strips along the river banks. These are utilized for growing rice, beans, corn, and a few bananas, coconuts, and breadfruit. Cattle may be seen grazing where the land is not subject to frequent flooding. Back of these narrow strips, especially in the lower regions of the river, the land is poorly drained and unsuitable for agricultural purposes. Most of the land is covered with a heavy growth of tropical forest trees and plants, especially palms.

The substation of Cukra Hill also is located on an estuary of the Escondido River about 20 miles from Bluefields. Established on an old banana plantation site, it contains a large area of excellent clay soil readily accessible to deep-water transportation.

Experimental Plantings

Although much time has been spent during the last 3 years in clearing land, constructing buildings, training personnel, and securing materials and equipment, considerable progress has been made in establishing experimental plantings. These include Hevea rubber, African oilpalm, cacao, abacá, citronella, nutmeg, vanilla, ginger, ipecac, various subsistence crops, and a number of tropical forest trees.

One of the most interesting experiments being carried on at the Station is that with mahogany, *Swietenia macrophylla*. Eastern Nicaragua contains many tropical cabinet woods, in scattered stands, most of which have not been developed commercially. The Station will lend assistance in classifying these trees. Large experimental plantings of mahogany have been made in the Station nurseries, and field plantings are being made at various localities throughout Nicaragua

An important source of essential oil and an aid in erosion control, lemon grass has been planted on steep slopes at El Recreo.

to find the best environment and soil conditions for commercial production of this tree. Other trees which are being experimented with are the decay-resisting Cedro macho, *Carapa nicaraguensis*, and what is locally known as rosewood.

With the assistance of the United States Department of Agriculture's Division of Rubber Investigations, more than 500,000 Hevea rubber seedlings have been grown in the nurseries and grafted with high-yielding clonal material from the Far East. Fortunately eastern Nicaragua is one of the few areas in the Western Hemisphere where the South American leaf blight has not made an appearance. More than 50,000 of these high-yielding rubber trees have been distributed to cooperating growers.

Other experimental work that is being carried on at El Recreo and Cukra Hill includes the interplanting of rubber and other long-term crops with various annual crops; improvement of processing, storage, and

(*Continued on page 14*)

Panoramic view of Nicaraguan Experiment Station at El Recreo, showing staff residences in left background and site of Administration Building in left foreground. Thickly planted area is rubber nurseries. Guest house and additional buildings are in right foreground. Village of El Recreo appears on other side of Mico River.

Controlling Cattle Ticks

Fever ticks are a great pest to cattle in the American tropics. The Institute of Agricultural Sciences at Turrialba is using a new combined spray solution to control them.

by ROBERT L. SQUIBB

One of the foremost cattle pests throughout South and Central America is the cattle tick, *Boophilus annulatus* variety *microplus*. Interest in an all-out effort to eradicate this serious pest in the American tropics is gathering momentum. To aid in the campaign, studies were undertaken at the Institute of Agricultural Sciences at Turrialba, through which a new solution designed for use as a spray was developed. This spray, consisting of a solution of rotenone and DDT in carefully tested proportions, is proving highly efficient in controlling ticks.

Most workers agree that the complete eradication of the cattle fever tick would both save the industry money and make breed improvement more rapid. This is true regardless of whether cattle in the Tropics have an immunity to tick fever, or whether future breeding of animals resistant to the fever is possible. Cattle imported into the American tropics to improve existing breeds often suffer as high as 95 percent mortality because of tick fever or piroplasmosis.

Deaths resulting from fever are only a part of the losses sustained by cattlemen because of ticks. As an ecto, or external, parasite, ticks cause severe anaemia and irritation leading to "tick worry." With a heavy infestation of these blood-sucking parasites, normal functions of the skin are impaired and resulting wounds are susceptible to secondary infections. These ill effects from ticks have a direct bearing upon milk production, growth, and physical well-being of cattle.

Present Control Methods Inadequate

In Costa Rica two methods of control are used. Small owners hand-bathe dairy cattle, oxen, and fattening animals with weak arsenical or concentrated salt solutions. Larger operators supplement these practices with dipping in vats.

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Dipping vats, however, are relatively few in proportion to the number of cattle. The Department of Liberia, for example, the beef-cattle center of Costa Rica, has only one vat for each 14,000 head of cattle, and the animals are so distributed over the area that many have to be driven 24 hours to arrive at a dipping vat. Observations show that cattle driven any great distance under tropical conditions lose considerable weight. Animals with hoofs softened by excessive humidity and water and those having to go through rocky volcanic terrain are subject to injuries during the drives, often becoming lame. Other difficulties encountered in dipping are mechanical abortion, poisoning, and injuries. These are usually due to inexperienced personnel and improperly designed vats.

After dipping, animals must usually be rested before returning to the pastures, in order to avoid losses from overheating. Oxen must often be rested a week, in some areas, before being worked. A 20 percent reduction in milk production for the week following the dipping of dairy cows is not uncommon.

New Control Method Tried

A new method for controlling ticks, which replaces the use of the cattle dipping vat in tropical regions, has been tried at the Institute. This method consists of using a newly devised combined spray solution made of rotenone and DDT, balanced so as to be specific against the cattle tick. A small spray gun, which holds

Studying the effects of the spray.

120 cubic centimeters of the solution, has been used throughout the trials.

More than 8,000 spray applications have been made, and the method has been found to be more economical than the cattle-dipping vat. Each animal was sprayed over lightly, beginning at the head and working toward the rear quarters. Folds between the legs and around the udders were carefully sprayed last. At no time in any of the trials were more than 150 cubic centimeters for each animal used, and the spray covered an animal so finely that after a few minutes one could hardly distinguish between the sprayed and unsprayed animals.

The most effective proportions for the combined solution were determined from experimental work covering a 6-month period on over 1,000 head of tick-infested cattle. Only heavily infested animals were employed in the tests, those averaging more than two ticks per square inch of body surface. The tests indicated that a rotenone–DDT combination was superior to the use of either ingredient alone. When the DDT percentage was increased in the combined solution, the percentage of ticks that died was not increased. On the other hand, if the percentage of DDT was reduced, the solution appeared less effective.

Properties of the Spray

In order to determine the influence of climate on the spray, tropical dry areas and wet lowlands which were noted for year-around heavy infestation of cattle ticks were selected for conducting the field tests. The combined solution was found to work equally well under dry and wet tropical conditions. For example, a continuous rainfall of 8 hours following application of the spray in one group of field tests did not interfere with obtaining an average of 93 percent mortality of the ticks.

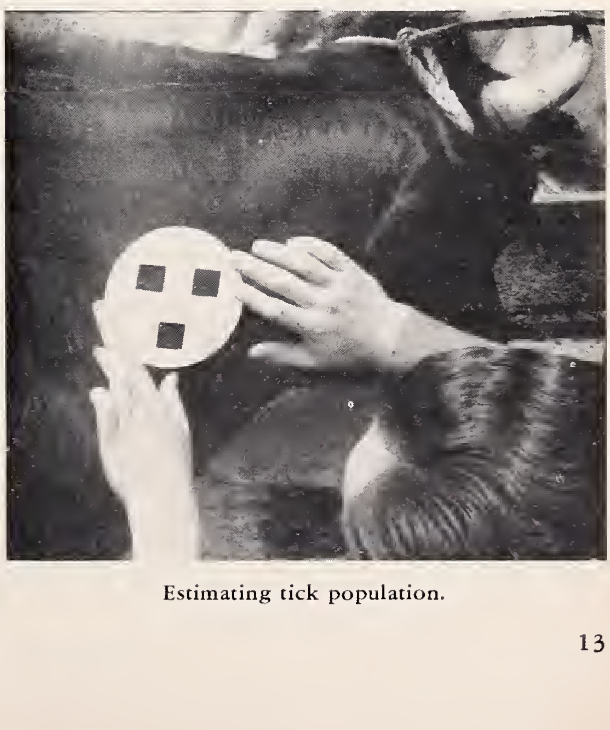
Observations were made to determine the possible poisonous or continued irritating effect of the combined solution. Even though the majority of the animals would lick themselves following a spray application, over a 6-month period, during which the combined solution was sprayed on more than 1,000 animals, no poisonous or continued irritating effects were observed.

A definite progressive killing action of the combined solution was observed to last as long as 7 days. By the end of the second day after the spray application, 20 to 55 percent of the ticks were dead, after the fourth day 55 to 85 percent were dead, and at the end of the seventh day 85 to 99 percent had been destroyed.

A herdsman with spray equipment.

Campaign Against Ticks

From the results of the experiments and field testing at the Institute, a procedure is suggested for carrying out a general eradication campaign. Spray each animal with 80 to 150 cubic centimeters of the combined solution at least every 14 days. If a greater amount of liquid is required for efficient coverage of the animal, dilute in the proportion of 1 part of combined solution to 1 part of water. Then 160 to 300 cubic centimeters of this mixture can be sprayed on each animal, with the same results. If more than these amounts were used for each animal, there was a waste of material.



Estimating tick population.

Care must be exercised in the selection of the spray equipment. A fine spray was found to be efficient.

Because the combined solution continues to kill ticks for as long as 7 days, a sustained program of spraying should completely control the pests in any given area in much less time than is necessary under previous control methods. Infested pastures can be cleared of ticks even more rapidly if animals are sprayed weekly. Very few ticks are found on animals so treated. This may be because of an active solution that destroys the seed ticks as they attack the animals. The principal ingredient of the combined solution, DDT, is known to have a lasting effectiveness.

Future Possibilities

The cattle fever tick is a real problem in many tropical regions for a number of reasons. There is a lack of sufficient cattle-dipping vats, of enforcement of quarantine and dipping regulations, and of control over ticks on cattle in transit. Not all cattlemen, accustomed to cattle ticks, are convinced of the economic significance of all-out control measures to eradicate this cattle pest. There are, also, certain tropical conditions that increase the difficulty of efficient control and regulation measures, such as an abundance of wild animals, extensive swamps, and areas without adequate transportation and communication.

That the tick can be controlled and even eradicated has been demonstrated by the results of an extensive and sustained campaign in the southern and southwestern portions of the United States. These areas, which formerly were heavily infested, have been practically freed of cattle fever ticks.

Possibilities of this new method of using the combined solution spray are interesting. Here is a method that is applicable to the problems of practically all cattlemen. Small owners can make efficient use of hand or knapsack sprayers. Larger operators can use power sprayers. The equipment can be designed to fit the needs of each operator, and practically all can be mobile. In this way the control medium can be taken to the animals instead of the animals to the control medium. Estimates at present indicate that the costs of using the new method run much smaller than those of cattle-dipping, even without the expense of the construction of the vats.

COLLABORATION IN NICARAGUA

(*Continued from page 11*)

marketing facilities for local and export crops; classification and uses of tropical oils; investigation of new cash and subsistence crops; and special plant pathology and insect-pest problems.

Rubber nurseries at Cukra Hill Substation.

Future of the Station

The future of the Station seems bright. With the removal of wartime restrictions on personnel, materials, and transportation, progress should be more rapid. One factor that will greatly aid in the work of the Station will be the completion of the all-weather highway from Managua to Rama. This would remove most of the isolation of the east coast of Nicaragua and give a strong impetus to the development and settlement of rich agricultural lands.

PALMS

(*Continued from page 9*)

the wild trees often taller, those in cultivation usually shorter. The leaves of the rather full crown are spiny at the base. The remarkably compact spiny fruit clusters or heads, wedged in the midst of the leaf bases, may produce from 1,000 to 2,000 fruits each.

Palms With Berry-Type Fruit

The oil-yielding palms discussed up to this point are more or less closely related botanically. Their fruits are drupes, or stone fruits, and contain a nut, which is marked by three eyes or germ-pores. Certain other palm groups have a berry-type fruit, in which the seed is not enclosed in a nut. In fact, the seed may be separated from the fruit flesh by only a thin membrane. Some of these palms yield pulp oils, but if the kernels contain oil the amount is usually insufficient for economic use. The flesh of these fruits is also used for various other purposes.

In this group are the feather-leaved patauá and bacába palms, well known in the Amazon Valley for their fine-flavored, reddish-purple to deep-violet, berry-like fruits from which refreshing drinks are

made. The fruit flesh yields pulp oils that resemble olive oil in chemical composition and can be similarly used for tinning fish and for salad and cooking oils. Patauá is *Jessenia bataua* (Mart.) Burret; *Oenocarpus distichus* Mart. and *O. bacaba* Mart. are the most important of the bacába palm species.

The fruits of burity and murity palms are covered from the top downward with overlapping scales, but they, too, are berries. The trees are impressive heavy-trunk palms that bear huge fan-shaped leaves as much as 16 feet in length and 10 feet in width. Burity, *Mauritia vinifera* Mart., is restricted to Brazil, from Pará to São Paulo, but murity, *M. flexuosa* L. f., occurs throughout the Amazon Basin and even beyond Brazil. These palms are extremely useful, the leaves as well as the trunks serving a variety of purposes. The fruits are also used, and in Pará and Piauí at least, the pulp oil is being extracted on a small scale commercially.

Jupaty, *Raphia taedigera* Mart., occurs only in the Lower Amazon section in Brazil but extends into Central America. It grows in marshes and flooded areas and is remarkable for its enormous feathery leaves, sometimes 50 feet long. The yellow flesh beneath the scaly covering of the rather large fruits produces a bitter red oil that is used in Pará for coloring soaps made of other oils.

Future Development

Brazil has made tremendous strides in the utilization of its oil-yielding palms, and the production figures are impressive. However, many stands of the best known oil-yielders are at present inaccessible and some species are not as yet being used on an economic basis. The development of these additional resources holds promise of even greater yields for the future.

Courtesy of Jason R. Swallen

A mucajá palm near Santarém, Pará.

QUEBEC CONFERENCE

(*Continued from page 5*)

extension and education, land tenure, cooperatives and credit, and the many scientific aspects of farming—soil management, insect and disease control, irrigation, and all the rest. From this reservoir of knowledge, all nations, large and small, will be able to draw help and advice. Suppose a big project for development of a country's resources is the logical solution in a certain case, involving the control of a river to provide power for new industries, such as fertilizer manufacture, and to make water available to farms. This project might call for advice of technical experts made available through FAO and for an international loan, if it could be arranged, through the proposed Bank for Reconstruction and Development. FAO has the responsibility of advising that Bank on the agricultural aspects of such loans.

FAO's services will also be available to those who produce for export. It will begin by building up a statistical world picture of the position of each important commodity, showing the present extent and location of surpluses and deficiencies and estimating what the situation is likely to be, say, a year hence; that is, what the trends are. This appraisal will lead to advice and recommendations to governments, suggesting, perhaps, in some cases joint governmental action in respect to a particular commodity. Where commodity agreements are made, the Quebec Conference has recommended that FAO share in their preparation, negotiation, and administration.

FAO is well placed for suggesting commodity arrangements that will be constructive rather than restrictive. To the producer, whose stocks are piling up and for whom prices are falling, the only remedy seems restriction of output. Similarly, an analysis by itself of the consumer's malnutrition problem leads to a dead end, with no solution in sight. FAO is founded on the belief that positive solutions emerge when both problems are considered simultaneously, the needs on one side and the supplies or potential supplies on the other, and that the only really useful proposals are those which benefit both producers and consumers.

Need for Cooperation

FAO cannot achieve these ends just by existing. It will not be useful unless it is used. It can collect information. It can analyze and recommend. Action has to be taken by governments, and only if governments put into practice the recommendations

(*Continued on page 18*)

ALONG THE *Agricultural Front*

▲ Inter-American Economic and Social Council Formed

The first meeting of the Inter-American Economic and Social Council was held early in November. This new Council was created at the Inter-American Conference on Problems of War and Peace in Mexico last March, to replace the Inter-Americal Financial and Economic Advisory Committee to the Pan American Union, organized in 1939 as an emergency agency.

The purpose of the Council is "to promote the social progress and the raising of the standard of living of all the American peoples; to undertake studies and other activities upon its own initiative or upon the request of any American government; to serve as the coordinating agency for all official inter-American economic and social activities . . . ."

The Council is to be subsidiary to the Governing Board of the Pan American Union, and the members will be representatives from each of the respective Governments.

▲ Research Center In Guatemala Proposed

Iowa State College is promoting the establishment of a Tropical Research Center in the city of Antigua, Guatemala. The Center is expected to be formally inaugurated in July 1946. To aid in laying a solid groundwork for the undertaking, a conference was recently called at Iowa State College, at which officers of the college and representatives of Mexico's and Guatemala's agriculture and of the United States Department of Agriculture met and discussed plans.

Unlike the *Instituto Agropecuario Nacional*, which is conducted cooperatively by the Governments of the United States and Guatemala, the proposed Research Center does not involve either Government.

One of the main objectives of this project in Guatemala is to develop improved varieties of corn and other plants of economic importance in an area which is rich in corn varieties and is the original home of some of the finest cultivated corn plants. Superior varieties will be studied, the best-known specific desirable characters stabilized, and these crossed in an effort to produce sorts suited to the specific soils and climates of various localities such as Iowa, Guatemala, and the other American Republics.

Iowa State College has already conducted preliminary breeding and selection experiments in Guatemala on certain varieties of corn which require a longer growing season than that available in Iowa. Many of the varieties were selected at fairs because they represented interesting types of corn. Some of the 30 or 40 varieties grow 15 feet tall and produce ears 12 inches long.

The proposed program offers educational features. The Research Center will provide opportunities for training a selected number of outstanding graduate students, who will be drawn from Iowa State College. When the maximum quota from Iowa is not reached, qualified students from other institutions in any of the American Republics, who register at Iowa, are to be admitted.

Through the work of the Research Center an increase in scientific interest is expected throughout the Americas.

▲ Agricultural Policy Aids São Paulo Production

In accordance with a Decree-Law of July 26, 1945, the Bank of Brazil has inaugurated an agricultural policy of crop-production loans on six basic foodstuffs. It has authorized its Agricultural and Industrial Credit Department to make such loans and has issued instructions to its agencies in producing areas to speed up the making of these loans in order to aid production. Loans may also be granted by private banks within its provisions.

Guaranteed minimum prices and the possibility of foreign markets may bring about a 20 to 40 percent increase in the production of these basic foodstuffs in São Paulo. Since these crops require less labor than cotton, there may be a reduction in the areas planted to cotton.

The State Secretariat of Agriculture is doing its utmost to supply high-quality seed to growers. All planting seed sold by the Secretariat is fumigated, cleaned, sacked, and sold at cost.

PARANA RIVER BASIN

(*Continued from back cover*)

directly into the gorge. The Iguassú Falls furnish about 2,592,500 potential hydroelectric horsepower.

A Varied River

Within the Brazilian borders the Paraná, Mother of Waters, is almost like two entirely different rivers. Above the Seven Falls it is sluggish and its red-brown waters spread over the lowlands from ½ to 2½ miles. During high water it spreads 3, 4, or even 5 miles, to form a wide boundary between the States of Paraná and Mato Grosso, but it is so shallow that, except after seasons of heavy rains, the small steamers must chart a careful course to avoid innumerable groundings. Hundreds of islands fold in and out of its windings, some as much as 30 or 40 miles long. Many tributaries, from tiny brooks to full-size rivers, slip into its water from level forest-walled banks.

Three hundred miles from the source the lazy waters of the upper Paraná encounter a chaos of rocks and gorges forming the picturesque Seven Falls. Below these falls, the Paraná, over 200 feet deep, is enclosed in a narrow rock-walled canyon until joined with the Iguassú. There it begins to widen out, changes its course to almost due west near Encarnación and occupies

a broad channel studded with large islands.

At the point where the Río Paraguay unites with it, the Paraná is 3 miles wide. From there it flows south. Near the end of its course it is joined by the Uruguay River and forms the great estuary of the Río de La Plata.

Characteristics of the Basin

Rainfall is abundant throughout the Basin, varying from 20 to 40 inches in the western part and from 40 to 80 inches in the eastern portion, with the exception of a small section in the vicinity of the Iguassú River which averages over 80 inches.

Although the Basin is partly located in a subtropical zone, the climate is healthful and not excessively hot even in the northern part because of the high altitudes. Temperatures are in the 70's in the summer and range from 48° to 61° F. in the winter.

Population varies from 79.2 persons per square mile in the State of São Paulo to 0.8 in Mato Grosso. Few habitations are found in the entire navigable length of the river above the falls.

Vegetation along the river varies as much as the river itself. In the northern part, the landscape is composed of prairies, scattered fields, and groups of burity palm trees. On the east side, in the States of São Paulo and Paraná are dense forests of Paraná pine or yerba mate. On the west side is scrub forest and grass land, a decided vegetation change which has never been explained. The State of Paraná is said to possess more than 800 million pines, rising from a base as much as 10 feet in diameter to heights of 200 feet or more. Among the pines, in isolated regions from 1,500 to 3,000 feet above sea level, immense areas of the yerba mate bush or tree grow wild.

In Argentina, the river flows through a region of scrub forest interspersed with patches of grassy savanna. There are places where the thorny deciduous trees grow so thick that penetration is difficult. In some places, near the rivers, taller trees form bands of dense semideciduous forest. The most interesting species is the quebracho tree, which contains a large amount of tannin. These trees grow best where the ground water contains salt. Farther to the south lie the prairie lands suitable for grazing and for grain production.

Agriculture West of the River

On the west side of the upper Paraná, in the State of Goiaz, a vast territory is occupied by a scattered and predominantly pastoral people. Agriculture in the scattered areas around the larger towns is devoted to corn, manioc, rice, beans, and sugarcane. Recently there has been a significant increase in the planting of tobacco.

Southwest of Goiaz lies the immense State of Mato Grosso, which, according to geologists and geographers is one of the oldest parts of the world. It is a high tableland, the source of many rivers. Little agriculture has developed along the Paraná.

In the southern part of Paraguay, cultivated land along the Paraná extends only a few miles inland and is of little importance.

Farther south, however, in Argentina are rich wheat, corn, and flax areas. The corn district centers on the river port of Rosario but extends for some 140 miles east and west and 150 miles north and south. Farther west, sugarcane grows around Tucumán and some cotton in Cordoba, although the area is chiefly given over to grazing until the grain belt is reached in Cordoba and Buenos Aires.

Agriculture East of the River

In Minas Gerais, when the excitement of the mining period had died down, the sparse population which remained began a rudimentary agriculture. With no roads or markets, and with only simple hand-made tools, the people had neither need nor incentive to grow more than their families could consume. Until 1920 this condition continued, with the exception of a few *fazendeiros*, or large farmers, here and there, chiefly in the Triangle bordering São Paulo. About that time the State became interested in agriculture, and since then the State has moved up among the leaders in the production of cattle, tobacco, corn, sugar, beans, rice, wheat, and fruits. It is one of the most advanced States of Brazil in the production of byproducts of milk and in the cultivation of wine grapes.

South of Minas Gerais lies the great State of São Paulo. Here the soil is *terra rossa*, a deep, porous, reddish clay containing considerable humus. It is excellent soil for coffee trees, and this State grows about one-half of all the coffee produced in the world. In the last 30 years cotton growing has come to the fore. Sugarcane is cultivated in several places, principally in the Tieté River Valley. Beans, rice, manioc, and corn—principal food of the people—are produced on a large scale, as are also various kinds of potatoes.

There are about 123 million acres in plains and pastures of excellent grasses, principally near the boundaries with Minas Gerais. The State of São Paulo possesses immense flocks of cattle, sheep, goats, hogs, horses, and mules.

Land in the State of Paraná is similar to that in São Paulo. More than a million people within its boundaries are busy, growing coffee, cotton, rice, and wheat, raising cattle, mining for gold or coal, working the extensive forests of Paraná pine for lumber and wood pulp and for the maté, from the leaves of which is made the drink that is to South American countries what tea is to Europe.

The delta of the Rio Paraná provides along the flood plain favorable conditions for fruit growing. Warm water brought from the north permits a long southward extension of tropical and subtropical plants.

What of the Future?

The Paraná may become of as great economic service to South America as the Volga, Danube, and Rhine Rivers are to Europe or as the Mississippi is to the United States. It drains one of the most highly developed agricultural parts of South America and offers possibilities to an extensive undeveloped region. It furnishes almost unlimited potential hydroelectric power for industry. With about 9,721,000 horsepower, nearly half that of all its States, Brazil's richest hydraulic potentialities are located in the Paraná River Basin.

The Pan American Yearbook, 1945. 829 pp., maps. Pan American Associates, Pan American Magazine Building, New York City, 1945. Here is a practical reference book and economic handbook containing information about all the countries of the Western Hemisphere. It is designed as a handbook for businessmen, travelers, and students. There will be a Spanish edition and a monthly supplement through the *Pan American Magazine.*

Part I of this book contains general information on the geography, government, transportation, people, agriculture, economy, and culture of the various countries. Part II has a chapter devoted to each country. Part III is a Who's Who in Inter-American Trade, listing more than 25,000 firms and representatives classified by industry and also alphabetically within each country.

Cultura de Café no Brasil. 300 pp., tables. *Departamento Nacional do Café,* Rio de Janeiro, 1945. This book is composed of tables, charts, and maps giving the results of the coffee census in Brazil which was begun in 1939. It is a collective reprint of separate results published previously in the *Review "DNC."*

Plantas Medicinales Aromáticas o Venenosas de Cuba, by Juan Tomás Roig y Mesa. 872 pp., illus. Cuban Ministry of Agriculture, Habana, Cuba, 1945. *Medicinal Plants, Aromatic or Poisonous, of Cuba* is essentially a catalogue in Spanish of Cuban plants known or believed to possess certain medicinal or poisonous properties. It is designed for the layman as well as the specialist.

Part I, occupying 738 pages, includes a glossary of medicinal terms and properties, classification of plants having similar medicinal properties, botanical classification of the plants according to the classification system of Engler-Gilg, detailed description of each plant with names, habitat, botanical description, uses, properties, and bibliography. The plants are arranged according to common Cuban names. Part II contains indexes of common Cuban names, scientific names, common names in other countries, and bibliography.

Costa Rican Life, by John *and* Mavis Biesanz. 272 pp., illus. Columbia University Press, New York, 1944. The authors tell about every-day middle-class living in Costa Rica as they saw it in Heredia, the coffee town, and in San José, the capital. They have written of the country itself, the basis of class distinctions, customs, crops—coffee, bananas, and cacao—education, work, play, and the interest in politics. A bibliography of books on Costa Rica and a detailed index are included.

Editor's Note.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

QUEBEC CONFERENCE

(*Continued from page 15*)

of FAO will they achieve the purposes for which they created this new body.

FAO ideals can become the basis for a new and more intimate cooperation between the nations in a broad field of production, distribution, and research. Acting together, nations can accomplish things that are impossible if they act alone. The peoples of the Americas already realize this. International discussions about frontiers and spheres of influence are fraught with difficulty and possible friction, but food and agriculture are different. Food is the basic need and agriculture the principal occupation of mankind. On these questions day-to-day collaboration between the nations is practicable as well as desirable. Nations have carried on just such collaboration during the emergencies of the war. Through FAO they may continue working together for the purposes of peace.

AGRICULTURE IN THE AMERICAS — O. R. CARRINGTON, EDITOR

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U. S. GOVERNMENT PRINTING OFFICE: 1946

Gifts of the Americas

MEXICAN LINALOE OIL

by BEATRICE DU FRANE

Without essential oils there would be no perfumes. Today, just as in the days of the ancient Egyptians and the Incas, these perfume oils are the lifeblood of the cosmetic industry.

One of these essential oils is Mexican linaloe, obtained from the wood, and to some extent from the fruit, of several species of the genus *Bursera* of the Burseraceae family, aromatic trees or shrubs native to tropical and subtropical America. These trees, which flourish even on poor or stony soil, are known commonly in Mexico as the Spanish linaloe and the copal limón. They grow in Mexico, principally in the States of Oaxaca, Puebla, Guerrero, Morelos, Michoacán, and Colima.

The oil is obtained only from wild trees, no efforts having been made to domesticate the species. To the producers, oil-bearing wood falls into three classes: the finest with a pleasant, delicate fragrance, another with a less-pleasing scent, and one with a caraway-like odor. None of the trees become oil bearing until they are about 20 years old, and the best oil comes from trees much older.

Since the wood of healthy linaloe trees does not produce any significant amount of essential oil, incisions are made to stimulate oil production. This method probably originated long ago when the Indians noticed that trees injured by storms produced large quantities of oil. "You must notch the tree on a night when the moon is full," native workers will tell you. Be that as it may, a number of producers agree that trees notched on a dark night will not produce. In lacerating the trees, strips of bark and wood are removed either in vertical gashes or step-like, horizontal cuts. If this process exposes yellowish, fragrant heartwood, the tree is ripe for cutting and extraction of the oil. If heartwood is absent, the tree, with its open wounds, is allowed to stand for a year or two until its white, soft wood changes to the valued heartwood. The incisions are slanted so that rain will not enter and the accumulation of injurious foreign matter is discouraged. If decay starts in spite of these precautions, the useless parts are planed off to prevent spread of the decay.

While the wood is sometimes exported in trunk-like pieces, most of it is processed in Mexico, the essential oil being obtained by steam distillation. In addition to working their own lands, producers frequently lease privately owned lands and send their workers in to cut the trees. Since no actual factories exist for extraction of the oil, the fallen trees are hauled to primitive distilleries, where the trunks, the only part used, are reduced to small chips with saws and machetes.

Made of galvanized iron or copper, the stills are usually located along river banks or streams because of the need for water. Distillation is carried on for about 6 months, beginning soon after the rainy season. First the wood is cut into small pieces and placed in the still to within a foot of the rim. Then, with water added to cover the wood, the still is fired by direct heat. Half a dozen Indians attend each still. Another man tends the fire, while still another occupies himself with the distillation itself. Distillation takes about 12 hours for each charge and is carried on day and night. The yield of the sweet-scented, colorless or sometimes pale-yellow oil averages about 2 percent.

Sometimes linaloe oil obtained from the wood is blended with that obtained from the fruit of the trees. Lacking the keeping qualities and the sweet odor of the wood oil, the product of the fruit is rarely sold independently. The greenish-red berry-like fruits are about the size of *garbanzos* (chickpeas) and yield 3 percent of oil. Distillation of the fruit begins in July and continues into September.

Production of linaloe oil in any given year depends largely upon weather conditions, ample moisture during the rainy season, June to October, being conducive to a high yield of oil. This is particularly true in the case of the fruit oil.

From Mexico this aromatic essential oil finds its way to the perfume manufacturers to take its place along with other essential oils from all over the world in the creating and blending of fragrant cosmetics.

PARANA RIVER BASIN

by **R. G. Hainsworth**

The Rio Paraná, fifth largest river in the world, with its tributaries, drains approximately 689,000 square miles of territory in parts of Brazil, Paraguay, and Argentina. It is about 2,750 miles long and is capable of accommodating ocean vessels as far as Puerto Mendes, Brazil, about 1,200 miles upstream.

Many Tributaries

Many tributaries unite to form the Paraná. The most northern, Rio Corumba, originates in the Brazilian State of Goiaz, where it competes with other streams carrying water north to the Amazon system and northeast to the São Francisco. Flowing south, it becomes the Rio Paranaíba, the name meaning Great River Full of Cataracts.

At the point where the States of Mato Grosso, Minas Gerais, and São Paulo intersect, the Paranaíba merges with the Rio Grande and becomes the Paraná. The Rio Grande rises in Minas Gerais near the border of the State of Rio de Janeiro. Later it forms part of the boundary line between that State and the State of São Paulo.

Rio Tieté rises in the Serra do Mar, near São Paulo city, within 20 miles of the Atlantic Ocean. It flows west across the State of São Paulo to unite with the Paraná on its long voyage to the Atlantic.

The next important tributary is Rio Paranapanema, which forms a boundary line between the States of São Paulo and Paraná. It too has its headwaters near the Atlantic and cuts through deep gorges to the Paraná River.

The Iguassú, one of the many rivers springing from the Central Plateau, rises near Curityba, the capital of Paraná, and flows west for 500 miles across the State to join the Paraná a few miles below the intersection of Brazil, Paraguay, and Argentina. As it flows, it gathers the waters of some 30 tributaries. Rio Iguassú is a large stream and flows in broad meanders through a dense forest. Rapids indicate that the stream is beginning to entrench itself. The entrenchment has proceeded far enough so that no flood plain exists, but a gorge has not yet been formed.

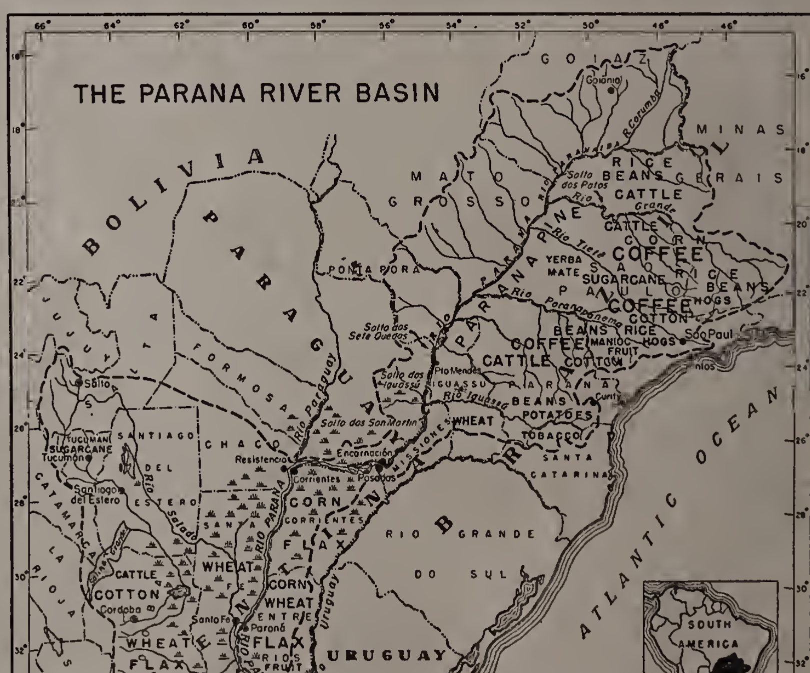
Two large tributaries flow into the Paraná from the west. Río Paraguay comes in just above Corrientes. Farther south, at Santa Fe, is Río Salado, which has its origin in the Andes in Argentina, over 20,000 feet above sea level.

Beautiful Falls

Throughout the length of the Paraná and its tributaries there are many beautiful falls. About 125 miles from the mouth of the Rio Grande are the Salto dos Patos Falls, with an hydraulic force of approximately 700,000 horsepower. Still within the Brazilian territory, and in the Paraná itself, are the picturesque Salto das Sete Quedas, or Seven Falls. In width and height Sete Quedas do not compare with more famous cataracts, but for picturesque beauty they are unrivaled. Each minute more than 13,000,000 cubic feet of water plunge over the falls, contributing 1,500,000 horsepower to the potential hydroelectric water power in Brazil.

Perhaps the most widely known falls in South America are the Iguassú Falls, about 12 miles from the mouth of the Iguassú River. Rio Iguassú, with a volume ordinarily less than that of Niagara but swelling greatly in times of flood, spreads its waters over a wide expanse of island-studded rapids before spilling them in a broken curtain nearly 2 miles wide into a gorge more than 200 feet below. The highest drop at Iguassú Falls is 230 feet, which is approximately 63 feet higher than Niagara. San Martín Falls on the Argentine side, carrying a moderate volume of water, are among the most attractive because of their double cascade along part of the cliff and their setting in a tropical forest, from which the water plunges

(*Continued on page 16*)



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Agriculture in the Americas

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NAMES & NEWS

Fred F. McKenzie Returns From Chile

Fred F. McKenzie, Professor of Animal Husbandry at Oregon State College, recently returned from Chile where he delivered a number of illustrated talks on artificial insemination and taught a class of veterinarians on the same subject at the University of Chile. He was invited to Chile by the Chilean Fomento Corporation. During his stay he visited a number of livestock farms at Valparaíso, Concepción, the Aconcagua Valley, and in the vicinity of Santiago. In recognition of his work in the field of artificial insemination Dr. McKenzie was made an honorary member of the Veterinary College faculty, University of Chile.

●

James A. Doyle Visits Mexico

James A. Doyle, Associate Solicitor in Charge of Agricultural Adjustment, Crop Insurance, and Labor, United States Department of Agriculture, has returned from Mexico where he conferred with officials of that Government regarding continued employment of Mexican farm workers in the United States during 1946. Because of the shortage of farm labor and to insure the steady production of essential crops during the last 3 years the Department of Agriculture was authorized, through the Farm Labor Supply Appropriation Act of 1944, to recruit native-born residents of the Western Hemisphere for work in the United States.

●

Virgil C. Pettit Visits Experiment Stations

Virgil C. Pettit, Agricultural Engineer in the Office of Foreign Agricultural Relations, left in January for an extended trip to Guatemala, El Salvador, Nicaragua, and Ecuador where he will assist with construction work at the various Cooperative Agricultural Experiment Stations. He will also visit Costa Rica and Honduras, returning to the United States next summer.

Argentine Agricultural Leaders Visit United States

Señor Herminio J. Giordano, and *Señor Febo U. Terzy*, Chief of the Wheat Production Division, and Technician in Charge of Agricultural Economics, respectively, of the Argentine Ministry of Agriculture, were recent visitors to Washington where they conferred with officials in the Bureau of Plant Industry and the Bureau of Agricultural Economics. Señor Giordano has registered for advanced work at Iowa State College, and Señor Terzy is a student at Cornell University.

●

Richmond and Manning To Study Mexican Cottons

Thomas E. Richmond, Agronomist for the Agricultural Research Administration, and C. W. Manning, Assistant Agronomist, Texas Agricultural Experiment Station, have gone to Mexico in search of wild or primitive species of cotton plants and to obtain seeds which may be used for hybrid experiments. It is hoped that from these experiments varieties may result that will be resistant to certain climatic and disease conditions in this country.

●

Capps and Harrison Investigate New Insect Pest

Hahn W. Capps and *Edgar C. Harrison*, of the Bureau of Entomology and Plant Quarantine, USDA, are in Mexico on a field trip to study the distribution, habits, and life history of *Leucinodes elegantalis* Guen. This is a newly discovered insect pest which has been found frequently on commercial shipments of early tomatoes and eggplants.

●

Senhor Ismar Ramos Studies Cotton Industry

Senhor Ismar Ramos, Chief of the Cotton Section of the *Instituto Agronômico* in Campinas, State of São Paulo, Brazil, has come to the United States to study the cotton industry. While in Washington he talked with members of the Bureau of Plant Industry, the Extension Service, and the Production and Marketing Administration.

Agriculture IN THE *Americas*

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Cattle Trailing in Mato Grosso

As in earlier times in the United States, cattle drives in Southwestern Brazil are still full of color and daring. Most of the cattle for eastern markets are rounded up and trailed long distances in true Gaucho style.

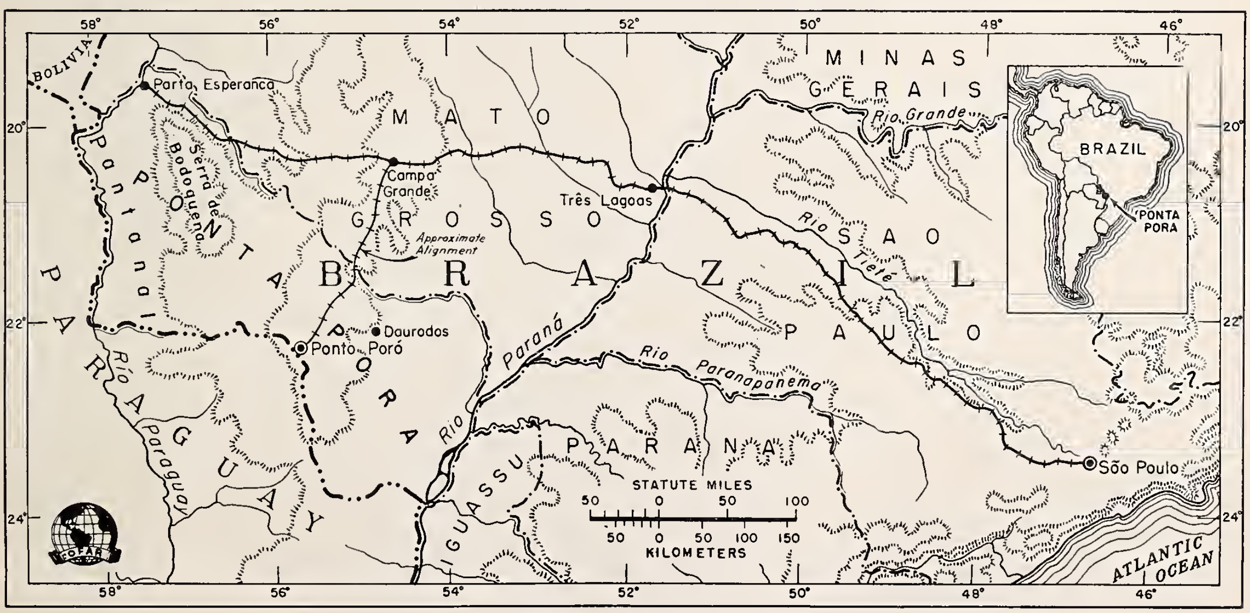
by F. E. DAVIS*

Untouched by modern cattle-ranching practices, the cattle handlers in Mato Grosso, Southwest Brazil, continue to round up their cattle in typical Gaucho fashion. These carefree gun-toting sons-of-the-border still prefer the rougher methods of handling cattle to keep up the old Gaucho tradition. Because of the mixed character and wildness of the cattle, the task of the buyer is a bit difficult, and considerable effort and time are required by a purchaser to secure a uniform and drivable herd.

* Based on a voluntary consular report submitted by John R. Hofmann, American Consulate General, São Paulo, Brazil, 1945.

The entire State of Mato Grosso covers an area twice the size of Texas, but the cattle industry is confined largely to the southern part much of which has now been included in the new Brazilian Territory, Ponta Porá. This region is about 440 miles wide and 380 miles deep. As in the early days in the United States, the principal problem is one of transportation. The region is crossed by only one railroad from the East, to which is being added a spur south from Campo Grande, the Dodge City of the region. Extending west from São Paulo, the railroad crosses the Paraná River at Tres Lagoas, the Kansas City of Central Brazil.

In this section of Mato Grosso, the land is sandy and covered with brush almost to Campo Grande. South



Gabriel blows his horn for the round-up.

from Campo Grande it improves in fertility, and between that region and the Paraguay border exist some of the richest *Terra Rossa* pastures of the region. This land is relatively clean, but as one approaches the border districts beyond the town of Dourados, he encounters a heavy growth of timber. To the westward the ranch land is variable, as far as and including the Serra de Bodoquena, but beyond this range the land drops off into the very rich Pantanal region, which offers pasture that will fatten cattle quickly. This fat does not remain, however, since the cattle rapidly lose weight when they are driven many miles east to market. A limited number of fat cattle are shipped direct by the one railroad to São Paulo, taking 5 days and 5 nights as a rule. As the cattle remain in the cars for the entire trip, they also lose considerable weight.

The Round-Up

At three or four years of age steers are rounded up to be sold and driven to fattening pastures in the East. These cattle are gathered into the *manga*, which is a securely enclosed pasture supplied with water. Here they are fed salt and then driven into a number of pens of the *mangueira*, the corral proper. From the pens they are driven in small groups into a sorting pen. There the buyer sorts the cattle and, as he shouts *boiada* or *refugo*, the individual steers are chased into a pen for the cattle drive or the pen for rejected cattle. Most of the cattle that enter the *refugo* are too young. Others are heifers that were mixed in with the steers, or are too thin, too old, or otherwise unsuited to make the trip. This sorting is an interesting and exciting but slow process. There is nearly always some maverick in the tamest herd that will insist on treeing the personnel, and others that jump the 6-foot-high log fence. Some fazendas, or ranches, do not have sorting corrals, and a rodeo is carried out in the fashion of the old-time round-up.

After counting the cattle, the buyer hands them over to the *boiadeiro*, or foreman, who contracts to deliver them to the buyer's fattening ranch. The cattle are then driven along routes to the East much in the same fashion as cattle were trailed to market in the United States in the 1870's and 1880's.

The Drive

A *boiada*, or herd of 100 head or less, can usually be driven by the *boiadeiro* and 3 cowboys. One is equipped with a horn to lead the cattle and rides ahead, while the *boiadeiro* and the other 2 men guard the flanks and rear. Fifteen to twenty miles a day can be covered by such a group.

A *comitiva*, or band consisting of about 16 men, can drive a herd of 2 to 3 thousand head. Such a group would include 3 foremen, 2 cooks, 3 riders that can sing and play a guitar, and 2 Gabriels to blow cow horns to lead the way. The contracting foreman receives a set payment per head of cattle. In addition to paying his help, including their return passage, and meeting the ordinary expenses of the drive, the foreman may have to pay fees for night use of corrals at fazendas along the way, although some *fazendeiros*, or ranchmen, do not charge at all. Such drives may be on the road the better part of a month.

Mules rather than horses are often preferred for long trips by cattle drivers who remain in the saddle for hours. The gait is a point of importance in the evaluation of a mount. The Mato Grossene prizes the *marcha* gait, a type of rolling stride which enables a horse or mule to cover greater distances at a fair rate of speed. A trotting horse is much harder on the rider.

The foreman, in accepting a herd to be driven, is especially interested in the strength of the animals, refusing lame and old animals that cannot keep up with the herd. He considers good branding the secret of a successful cattle drive. A premium is also set on tame cattle, since they are more easily kept together in such places as the sandy *sertão* near the Paraná River and require less lassoing. The trailing

Mr. Davis has had a broad experience in crop and livestock estimating work. For the last 3 years he has served as Senior Economist for the Office of Foreign Agricultural Relations.

or driving follows roads in most areas rather than trails over open range in the fashion of the Chisholm and Cimmaron trails of early cattle days in the United States.

The Cattle

The so-called native cattle of Brazil have their origin in the Iberian cattle imported by the early Spanish settlers. Some crossing has been tried with the heavier Hereford, Shorthorn, and Angus breeds, but these have met with almost complete failure, and such crosses now exist only in the border districts next to Paraguay. The crossing of the Brahmin or Zebu bull with the native cows has met with the greatest success and, in general, cattle in Mato Grosso are valued on the proportion of Zebu blood which they have. The Brahmin or Zebu with its dark skin and light hair is suited to an environment with a hot sun. It is able to range widely for its food, which is important, since the best pastures deteriorate considerably during the dry season. The best type of bull for breeding purposes is the Indobrazil, a cross of the two pure Zebu lines, Guzerat and Gyr. The pure Guzerat is handicapped by bones which are too heavy and the hanging of the under part of the body so low as to invite injury. The Gyr strain produces too large udders for beef cattle and calves that are too weak. The mixture of the two corrects these defects and creates the tamer Indobrazil type.

Calves are generally born in September and October

Cattle are carefully sorted in a corral.

at the end of the dry season. A calf crop of but 40 to 50 calves per 100 cows is usually secured. It is considered good practice to keep the calves near the ranch buildings until they have been branded, often in a special corral provided with shelter, into which the cows are brought at calf-feeding time. This procedure enables the rancher to treat any infection with dips and greatly reduces one of the major sources of losses. The calves are branded, usually low on the hind quarters or on the hump back of the neck, when they are about 1 year old.

By periodically salting the whole herd in the *manga*, using a horn to announce the treat, the cattle are tamed and prepared for easy driving. In many parts of the Pantanal in the west, however, cattle are allowed to breed in a semi-wild state deep in the brush and associate with men only at periodic rodeos.

A visiting *fazendeiro.*

The Ranch

The principal characteristic of cattle ranching in Mato Grosso is that it is done on an extensive scale. One square league, about 9,000 acres, is considered a little fazenda, or a *fazendinha*. It is customarily fenced in with miles of smooth steel wire, in preference to barbed, as the smooth wire offers less danger of infection to the livestock.

Three men are generally considered sufficient to care for 1,000 to 1,500 head on 1 or 2 square leagues of fairly clean open campo. More are necessary in bush country. The 3 riders are able to form a V for driving, 2 men usually being used to throw steers by lariat, leaving the third free to perform any other necessary operation. Their principal duties are to check and repair the fencing; watch for sickness in the herd; give special attention to new-born calves and cows that are about to bear or have recently borne

calves; brand the yearlings; castrate the 2-year-old bulls; salt the cattle periodically; and finally to round up and separate the cattle to be driven to market. Practically nothing is done to prepare forage either by planting pasture, making hay, or preparing silage.

The average fazenda is self-sufficient as to its food supply except, perhaps, for a little rice, sugar, and *herva matte*. Since needs in the way of wearing apparel also are simple, the ranch's operating expenses requiring an outlay in ready money are largely restricted to purchasing salt, if the fazenda does not have a salt lick; to paying the help, if the fazenda is not run by members of the family; to purchasing wire for repairing fences; and to replacing a few simple tools.

The *manga*, or enclosed pasture, and the *mangueira*, corral proper, are enclosed with fences made of ironwood, which is very hard. The fences are constructed by erecting pairs of logs in post holes at regular intervals of about 10 feet. Logs are laid between these posts, with the ends of the logs in one section resting on the ends of those in the next section, much the same as corrals are constructed in the United States. The tops of the two upright posts are wired together. On some fazendas these pairs of upright posts are replaced by a single notched-out post.

Another necessity on a ranch is a *galpao*, which is a semi-enclosed shed provided with a tiled or thatched roof under which hammocks may be stretched and a fire built. This is often used by the rancher's family until a more comfortable ranch house can be completed. Then the *galpao* serves as a guest house for visiting cattle drivers and their men.

The installation of small power plants utilizing water or wind power or even oil, for electrical lighting and other small electrical equipment, would greatly improve the attractions of the ranch. As it is, many stock breeders spend much time at favorite resorts in the East, leaving the ranches to run themselves.

Trail's End

For most of the cattle moving east out of Mato Grosso the trail ends in the fattening pastures of the State of São Paulo. Here in rich pasture regions the aristocracy of the cattle industry of Brazil operate ranches and sell their finished cattle to the *frigorificos*, or packing plants, in the city of São Paulo, the Chicago of Central Brazil. Only a few cattle, primarily from pastures adjacent to the one limited-capacity railroad traversing Mato Grosso, move in finished condition from ranches in the West to the *frigorificos* in the East.

The trailing of cattle from the West takes place in stages. Large operators with fattening pastures in the East make buying trips to the ranches farther west or hire buyers to assemble a band for driving to the East. Many have grazing and breeding ranches along the way. These large operators are often breeders, buyers, and fatteners. From the frontier districts, 3-year-old steers are purchased and started on the trip to eastern markets, eventually reaching the slaughtering plants at 5 to 6 years of age. They may change hands several times as they move from ranches in one region to those in another, or they may be driven under one ownership from one ranch holding to another, finally ending up in finished condition at the eastern markets.

Purchase of cattle is usually made at the ranch. Unlike conditions in the United States, there are no central markets through which stocker and feeder cattle are sold. The accepting of cattle at the ranch by the purchaser or his agent gives rise to a great many professional drivers, who, with their helpers, trail the cattle from the producing ranches.

The cattle are guided through the gate of a fazenda near Maracaju. A conductor stands by to count heads.

Hillside farm in Guatemala.

Agricultural Extension Project In the Other Americas

Extension work can do much to help farmers meet successfully their problems of living and of crop production. In South and Central America an Extension Program is getting under way with the distribution of a series of agricultural publications written in simple Spanish.

by DOROTHY E. CHAPMAN

Extension work as the term is understood in the United States has not yet been developed to any great extent in the other American Republics. There are few or no organized national extension agencies with subdivisions in the States or *Departamentos*, and correspondingly few county agents under them to aid the millions of small farmers with their many problems of diet, low yields, and erosion. Interest is developing, however, in ways and means of reaching the farmer. One new development consists in the preparation of a series of circulars in simple Spanish dealing with the most important problems of the farm and home.

The project is based on the work of the experiment stations in which the United States Department of

Agriculture, through the Office of Foreign Agricultural Relations, and the Governments of Peru, Ecuador, Nicaragua, El Salvador, and Guatemala have been collaborating. The purpose of these stations is to grow crops complementary to those produced in the United States, which, for our everyday economy and habits of living, the United States needs but does not produce; and animal and plant products required for local subsistence by farmers who are growing the complementary crops. Early in the war period scientists from the United States were sent to help staff the stations. The other American governments furnished land, erected the necessary buildings, purchased certain equipment for their use, and provided labor and additional staff members.

Now, after several years of existence, the stations represent good focal points from which to introduce and carry out extension work among the farmer producers of these countries. Sociological surveys of the people and their living habits and needs, preliminary to initiating extensive programs, have already been conducted in Peru and Ecuador and a similar study is now in progress in El Salvador.

Farm Circulars Prepared in Spanish

When the decision was made to prepare a series of circulars in simple Spanish for the use of the farmers of the countries in which the collaborative programs were being carried on, the writer went to South and Central America to work on the project and spent 4½ months of the past spring and summer at the cooperative stations in Peru, Ecuador, El Salvador, and Guatemala.

Peruvian farmer with the ever-present machete.

In general, each bulletin is written for one of the two following purposes: (1) to teach a skill to, or improve the production efficiency of, a farmer for his own direct benefit, or (2) to present some results of the station's experimental work which would directly increase the yield of a particular crop and thereby improve the status of a farmer through his increased earnings.

Although there are considerable differences in the types and living habits of people comprising the small-farmer groups of the various countries, their general problems and needs are similar. The need for more food and better diets is one problem; treatment and avoidance of the diseases which attack their crops is another; and most important is the need for proper planting practices to produce immediate higher yields and to avoid the devastation of soil through erosion or from other causes.

The Cooperative Agricultural Experiment Station at Tingo María is an important factor in improving the standards of Peru's farms and farmers.

The author, who is an Agriculturist in the Office of Foreign Agricultural Relations, has traveled widely in South and Central America. She returned recently from a trip to Guatemala, Peru, Ecuador, El Salvador, and Mexico, during which she gathered material for a series of agricultural leaflets in Spanish.

The subject of diet, alone, is one of great importance. Cattle of the best breeds, both for beef and milk production, are lacking entirely in some sections and are not widely prevalent in many countries. The whole field of animal husbandry is a new and important one to the life of the people. Corn, rice, and beans are the month-in-and-month-out usual diet of thousands of Latin American families. Fruits and different vegetables which will grow well with little care are needed. The gap between the station where the seeds are obtainable and the people who need them must be bridged more adequately if farmers are to know of, ask for, and grow the fruit and vegetables which would mean so much to their families. Several circulars have been directed at this problem.

Planting Practices at Tingo María

Improvement of planting practices is also important. Often special problems arise in individual situations which call for new knowledge. The experimental station at Tingo María in Peru is an example of such a situation.

Tingo María is on one of the headwaters of the Amazon River at the edge of the jungle. The recently completed road from Lima, on the Pacific coast, to Pucallpa, on a tributary of the Amazon, has opened a great region east of the Andes Mountains for settlement. The Peruvian Government is encouraging colonization in this area through the provision of land on a modified homestead basis and other facilities.

It so happens that one of the two main groups of new colonists in Tingo María is composed of Indians from the *sierra*, or high mountain section, of Peru. Their agricultural practices have developed through generations of farming in a climate characterized by strong winds and low rainfall, where, to conserve all possible moisture, plants are individually placed and grown at the bottom of deep holes. This system is quite different from that of making beds and furrows. The Indians have brought this habit with them to their new home. Tingo María, however, is in a tropical forest region with heavy rains and high humidity. Water collects in these holes, and the ever-present fungi make a tremendous growth, causing crop diseases which the farmers have never before experienced with their crops.

Many of the circulars explain the proper methods of planting in this new environment and the specific crops which are needed for subsistence there. Simple diagrams show what should and what should not be done, with the results of each practice, so that everyone in the community can gain useful information from them. Other circulars have been written on such subjects as the proper plants to use as cover crops in plantations of rubber or cinchona, why they are preferable to certain others, and how to introduce and maintain them.

Yellowing Corn Problem in El Salvador

In El Salvador a serious problem has arisen with the widespread yellowing of corn plants, the staple subsistence food crop. Among the Indians the yellowing is generally believed to be caused by either one of two conditions: (1) too much rain, or (2) not enough rain. Through the cooperation of one of the large *hacendados*, or estate owners, the station staff set up corn test plots to which were added varied applications of nitrogen, potassium, and phosphorus fertilizer. Certain untreated plots and the widespread planted corn fields of the hacienda served as controls. As the plants grew, there was the evidence for the *hacendado* and the entire neighborhood to see: wherever nitrogen had been added, the corn grew better and remained green; in the other plots the usual yellowing occurred. This was a simple but necessary demonstration of a widely understood practice. A circular describing this comparatively simple cure has been written and is now being given to those who inquire about the yellowing of corn.

Complementary and Forage Crops

In several cases the bulletins endeavor to present the methods of propagation and harvesting of a complementary crop entirely new to the farmers of a country.

(*Continued on page 38*)

Many small farmhouses have roofs thatched with leaves from the palm trees that grow nearby. Sugarcane and bananas often grow near the house.

Cinchona Investigations In Puerto Rico

Experiments are under way in Puerto Rico to determine environmental and cultural factors essential to the development of strains of cinchona which will grow successfully and furnish future supplies of planting material for the Western Hemisphere.

by ROY E. HARPER
and HAROLD F. WINTERS

A dozen or more species of cinchona, the plant from which quinine is obtained, grow in South and Central America, the most important being *Cinchona officinalis* var. *ledgeriana*, which has high alkaloid content in the bark, and *C. pubescens*, relatively low in alkaloid but more robust and having the ability to grow on poorer soils. Both species and their hybrids are under experimental cultivation in Puerto Rico.

Early Plantings

During the period 1935 to date, several importations of cinchona seedlings from the Division of Plant Exploration and Introduction, U. S. Bureau of Plant Industry, were made and these were tested at five different locations on the island. The Las Mesas planting at an elevation of 1,000 feet and with good wind protection grew well at first but had a short life. Of the trees planted at Castañer and at La Quinta at an elevation of 3,000 feet over 70 percent were either dead or diseased after the first 3 years and still poorer results were obtained at Doña Juana. The highest survival and best growth were obtained at the Maricao Forest, on a leeward southwest slope of a mountain at an approximate elevation of 2,000 feet. In 1939 a nursery was established at Maricao and this became the center of cinchona work in Puerto Rico for the next few years.

These *Cinchona ledgeriana* seedlings were grown at U. S. Plant Introduction Gardens, Glenn Dale, Md., and shipped by air express to Puerto Rico. The plants arrived in excellent condition and a good survival was obtained in transplanting.

By 1941 after some experimentation several thousand cinchona seedlings were produced and planted in nursery beds, but in general the growth at Maricao was not satisfactory and the conclusion was finally reached that the climate had too many extremes for the successful propagation of this crop.

A New Location

In 1941 another location at higher elevation was selected in the Toro Negro National Forest. This area, located at an elevation of 3,000 to 3,500 feet and in a valley between two mountain ranges, is considered to have better protection from the prevailing winter winds at a time when rainfall is low. The land was at one time a coffee plantation but in 1935 was returned to forest. Although clay soils predominate in the high areas of Puerto Rico, this particular area contains loam soil derived from granite and related volcanic materials.

Approximately 14,500 cinchona seedlings were received from the U. S. Plant Introduction Gardens in June 1943 and January and February 1944. The plants were well hardened and as a result of improvements in packing and of shipment by air express all arrived in excellent condition. The majority were planted in nurseries and were ready for field planting in 1945.

Special-Type Shelter for Seedbed

In order to provide the environmental conditions necessary for germination of the seed and early growth of the seedlings, a special-type shelter is used. These sheds are 50 feet long, 6½ feet high at the ridge, from which the roof slopes sharply to the back where the eaves are 2 feet above the ground, and each protects a single seedbed 3 feet wide. A front span of roof 2½ feet wide from the ridge pole gives added protection. Small hewed logs imbedded in concrete form the upright supports. Seven-foot lengths of galvanized iron are used as roofing material, over which an insulating layer of palm leaves is placed to prevent heating by the sun.

The shelter faces north and the seedbed is placed toward the back to avoid direct sunlight upon the plants. The beds should be raised slightly above the level of the surrounding soil and made as nearly level as possible so that moisture will be uniformly distributed. The retaining walls of the seedbeds are built of creosote-treated lumber, to avoid wood-rotting fungi which produce a thick growth of mycelium over the surface of the soil. The persistent dampness under this fungus growth encourages damping-off diseases.

For the seedbeds the best of the soils tried in Puerto Rico is a mixture of screened leafmold or duff and siliceous fine sand. Seeds are sown on the surface, 1 or 2 grams for each square yard, and covered lightly with pulverized dead tree-fern stumps, to keep moisture uniform so that less watering is required. For about a month, until most of the seed have germinated, the surface of the bed is kept damp by sprinkling two or three times a week. Soil-moisture control is the most important factor in the success of the seedbed. After germination, the surface of the seedbed must be allowed to dry slightly between applications of water. This alternation of dryness and dampness stimulates root growth and prevents development of fungi.

In order to control light properly, the front of the shelter is closed at the time of planting to exclude about 90 percent of the light and to keep the humidity high. Lightweight canvas or double layers of palm leaves hung across the front are equally effective. After germination, the intensity of light admitted is gradually increased by removing shading material from the front, until the young seedlings are receiving all possible indirect light. A sudden excess of light may induce a characteristic reddening, and growth may be checked if the condition is not corrected.

Nursery Beds

When the seedlings are 2 or 3 inches high, usually after about 5 or 6 months, they are ready for transplanting. Sites for nursery beds are chosen to provide natural protection from wind. Good shade protection furnished by trees surrounding the beds is desirable, but all trees are removed from the beds themselves to eliminate competition for soil moisture and nutrients. The beds are 3 feet wide and are lined up east and west, with an aisle of the same width between.

The nursery beds are similar to those used in Java. Surfaces are raised about 1 foot higher than the level of the ground by a retaining wall of small poles. Frames, 2½ feet high at the back and 5 feet at the front or north side, are made over the beds to support a shelter of palm leaves. This shelter prevents rain from beating down the young plants and provides the needed shade. Shallow ditches are dug in the spaces between beds and deeper ones around the entire area to carry off quickly surface water after rains. The soil mixture giving the best results so far is composed of equal parts of leafmold and a granitic sandy loam soil or subsoil which occurs on steep slopes in the Toro Negro area. This mixture gives the fertility necessary to produce satisfactory growth and yet provides the essential drainage.

For planting in the nursery beds the seedlings are lifted without soil from the seedbed and planted, at

Nurseries are built on wind-protected sites. The beds are 3 feet wide and 3 feet apart. Palm leaves protect the young plants from sun and beating rains.

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a spacing of 6 inches on the square, without trimming the foliage. Growth is satisfactory for several months in these nurseries.

Because the sloping shelters of palm leaves tend to exclude light from the rear of the beds, the front rows of plants outgrow those in the back, resulting in even greater shading. Tests are now being made to determine how rapidly the shade can be removed, but hard and fast rules can hardly be established, as much depends on season, type of weather, overhead natural shade, and the general condition of the plants themselves.

Disease and Insects

Disease is an important limiting factor in the propagation of cinchona in Puerto Rico. Susceptibility to disease has been found to be closely associated with adverse soil conditions in the nursery. High water content and resulting poor aeration in the soil tend to prevent root development and produce unhealthful conditions in which the roots become diseased and die back.

A stem canker and two root diseases, found in 1940, are associated with high losses in the nursery and field plantings. One of the root diseases has symptoms similar to those of the gray root fungus of Javanese cinchona plantings caused by the *Graphium* or imperfect stage of a species of *Rosellinia*. The canker is similar in symptoms to a disease found in Guatemala and Peru, caused by *Phytophthora parasitica* Dast. Some control was obtained by eradicating wilted seedlings from the beds and by cutting back the tops of infected plants well below the dead tip.

A cinchona tree planted in 1943. Growth 20 months later was considered satisfactory.

The most serious insect pests attacking cinchona in the seedling and nursery stages in Puerto Rico are various species of thrips. The most common of these in the seedbed is *Anaphothrips Chaetanaphothrips, orchidii* (Mlt.). Other species which have damaged the nursery beds are *Heliothrips hemorrhoidalis* (Bauché) and *Scirtothrips longipennis* Bagn. A spray of nicotine sulfate, 1–600, has proved somewhat effective but is not a complete control. Derris-talc dust containing 1 to 2 percent rotenone gives satisfactory control when applied regularly at 1- or 2-week intervals. During periods of low humidity, red spider, *Tetranychus* sp., may cause considerable damage to the seedbeds. Dusting sulfur has given control of this pest. Various scales, including *Coccus viridis* (Green), *Aulacaspis pentagona* (Targ.) and *Saissetia hemisphaerica* (Targ.), may also become pests during dry weather, but they are brought under control by parasitic fungi during moist periods.

Observations of these various diseases and pests have been made by plant pathologists and entomologists at the Puerto Rican Station and results published in Station reports and scientific journals.

Field Planting

After a year or two in nursery beds cinchona plants are from 12 to 18 inches in height and are ready for transplanting to permanent locations in the forest. In Puerto Rico this is best done during the rainy season, which extends from July to November. At this time there is less wind than during the dry season, and almost daily showers assist in getting the plants established.

On long slopes, terraces are necessary to conduct away the surface water and prevent the formation of gullies. Close spacing of these terraces, at intervals of 4 or 5 feet in elevation, controls the surface water and aids in conserving the soil, but the same amount of land will accommodate fewer trees than if the terraces were farther apart.

The land is prepared for cinchona trees by digging holes 4 feet apart. Each hole has a capacity of about a cubic foot. It is filled with leafmold and covered with a 6-inch mound of soil until planting time.

With all preparations made in advance, planting proceeds rapidly once the rainy season begins. Some pruning or defoliation is necessary at time of transplanting. Seedlings up to 3 feet high that have recently made rapid growth are cut back to mature wood, about a third of the stem being removed.

(*Continued on page 37*)

Sheep and Goats Make Money for Brazil

War experience demonstrated the possibility of increasing export trade in skins of hardy goats and hair-sheep. Exportation of these skins from the ports of Northeast Brazil amounts to more than $3,000,000 annually.

by BENTLEY B. MACKAY

Drought often withers the interior of Northeast Brazil as it does few other parts of the world. In the worst years, vegetation almost disappears. Cattle and horses die or are driven to the Atlantic coast and sold for the hides. Their owners huddle in the coastal towns to wait for rain. The few inhabitants who remain in the interior are sustained by two creatures that live in spite of drought—goats and hair-sheep.

In this desert, known as the *sertão*, nearly every family keeps sheep or goats, drinking the milk, eating the flesh, and selling the skins, which move into world trade for the manufacture of fine gloves, shoes, and aviators' equipment. Year in and year out, the goat and his hardy companion, the hair-sheep, contribute greatly to the economy of the region.

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Although the eight States of the Brazilian bulge—Baía, Alagoas, Pernambuco, Sergipe, Paraíba, Rio Grande do Norte, Ceará, and Piauí—are regarded in the rest of the country as a more-or-less deficit area, the region is a heavy producer of wax and oils, hides, cotton, sugar, fibers, minerals, and semiprecious stones. Even so, it is far from self-sufficient. In the interior, particularly, life is precarious for men and animals.

In parts of the *sertão*, annual rainfall amounts to 16 inches or less a year, and even that falls in such concentration that droughts are often preceded by floods. The Federal and State governments are endeavoring to improve the situation with storage dams, but nothing has been successful in making the area fully suitable to permanent cropping.

Plant life has a hard time existing at all in the sandy, rocky soil, yet there is a covering of vegetation—shrubs, stunted trees, cacti, and tough sparse grasses—and this furnishes feed for millions of sheep, goats, burros, and many types of bird life, including the South American ostrich-like emu.

Chief among the trees of the region is the *joazeiro*, a native jujube, which from a distance resembles the wide-spreading live oak of the southern United States. It stands 30 to 40 feet high, is resistant to drought, always remains green, and produces marble-sized yellowish fruits, fairly sweet, that are relished by men and animals. The wood is durable and widely used locally.

There are innumerable cacti which furnish some water and feed for livestock. The *palma*, or Burbank spineless cactus, is grown in enclosures and chopped and fed to cattle and goats during extreme drought. Various grasses and legumes, such as *chique-chique*, also provide feed during droughts. Another plant of the region, well known in desert areas, is the Rose of Jericho, which lies apparently dead during the dry months but revives when placed in water or when the rains come. The people boil and drink the tea from this plant, believing it is good for practically anything that ails mankind. There are endless varieties of grasses, some familiar and some little known.

Over this ungracious terrain range millions of sheep and goats, appearing to the visitor to be running literally wild. Actually, they belong to individual families, in herds of from 6 to 50 goats or sheep or both, and in some manner each owner seems to know his animals from the others. The herds receive little or no care, and it is as hard to estimate production costs as it was to determine the cost of a Longhorn in early Texas.

A familiar figure in the *sertão* is the *vaqueiro*, a herdsman who tends goats and sheep along with cattle. He is usually dark, of Portuguese and Indian blood, slight of build, and sparing with words.

Often these men work for the owner of a fazenda. The universal understanding appears to be that the owner will supply the original stock and the *vaqueiro* will receive a fourth of the increase in return for his work as a herdsman. He also may live near the fazenda and receive advances of beans, flour, rice, clothing, and perhaps horses or burros. These men are proud of their locally made suits of cowhide and their wide-brimmed, point-crowned leather hats with ornate designs. They wear leather mittens, with the thumb and most of the palm free, as a protection against the thorny brush. The *vaqueiro* is usually the last to migrate to the coast. He goes only when droughts become unbearable and not until he has done everything possible for his cattle. He does not often bother with his goats, for he knows that most of them will still be on hand when he returns.

Hair-sheep are afraid of strangers, but know their *vaqueiro* masters. From a distance these sheep look like goats, with which they roam the *caatinga*.

Brazilian Hair-Sheep and Goats

There is only one type of sheep in the Northeast that continues to thrive on a starvation diet while imported European breeds die. It is the *pé duro* (hard foot), small of bone and weighing 40 to 50 pounds when grown. Instead of wool, it has short, coarse hair, varying from white to dark brown and almost black.

From a distance these hair-sheep are almost indistinguishable from the goats with which they run. Their origin is not definitely known, but Prof. N. Athanassof of Brazil is of the opinion that the breed came from Portugal with the early explorers and is the *Carneiro Bordaleiro Grosseiro* from that country. Others find the sheep similar to the *Bergamasea* of North Africa and Arabia.

Apparent evidence of crosses with wooi types may be seen in tufts of wool along the backs, sometimes extending halfway down the sides. Some Brazilian agricultural leaders believe that such crosses are of little value and that efforts should be concentrated on breeding for quality in the present type rather than attempting to produce wool.

During the years these sheep have become resistant to many of the common diseases, especially in the dry areas, where they are prolific. The most common enemies are wild animals, hawks, and vultures. Only in wet zones do they succumb in great numbers to various ailments, especially anthrax and internal parasites. This is also true of the goats.

The hair of these Brazilian sheep is of little value, but the skins have long been known in commerce.

In the United States and in the Brazilian trade the hides are called *cabretta* (little goat) to distinguish them from goatskins. The name was first applied by a trader in Recife about 1880 and is sometimes used incorrectly to describe the skins of all hair-sheep, including the North African strains.

In color the goats of the Brazilian Northeast run the entire gamut of Joseph's coat. They are little different from "just goats" anywhere in the world, except that they are more sleek and, in years when drought is not too severe, their short-haired coats glisten. They average in weight about 40 to 60 pounds. Over the years, through natural evolution, there has developed a hardy goat known in Brazil as the *Moxotó*. Some are white with a black stripe down the back, some are black and white spotted. The State and Federal governments have selected the finest of these animals for breeding and are releasing them to growers. In addition, Nubians, Toggenburgs and Black Lombardies may be purchased at moderate cost from government breeding stations.

The Industry

The slaughter of sheep and goats in the interior follows no fixed pattern. In time of extended droughts the slaughter is heavy. Refrigeration is unknown, even in some of the larger towns. All kinds of meats are sold on the day of slaughter. It is customary for people to come to town on market day, usually Saturday or Sunday. They drive the live animals for many miles and slaughter them on the roadside just outside of town. The fresh skins are rolled up and taken home to be dried in the sun.

When there is an accumulation of skins, the owner loads them on his burro, or burros, and sells them to a buyer in the nearest town. When the buyer has a truck-load he ships the skins to a seaport such as Fortaleza, São Salvador, Recife, and Natal.

A *vaqueiro* starts to market. Each donkey carries about 150 skins.

Exportation of goat and sheep skins from the ports of Northeast Brazil is a business amounting to more than $3,000,000 a year. Records for 15 years indicate exports of about 5,000,000 skins a year, regardless of price, with the United States the chief buyer.

During the war, Brazil began to tan and use a larger percentage of its sheep and goat skins than ever before. The United States, which took from 80 to 95 percent of exports before the war, dropped off to less than 50 percent in 1943 and 1944. In contrast, South Brazil and local tanneries took nearly half the skin production of the northeast section in 1943, and the same held true in 1944. This change is attributed largely to the fact that the United States ceiling price was not high enough to encourage shipments, whereas shortage of leather goods in Brazil, increasing local buying power, and lack of price control made it possible for local tanneries in South Brazil to outbid North American buyers. While local tanning methods are crude and the quality is poor, this leather serves a need in areas where more expensive leathers are not available.

In August 1945, skins 200 miles in the interior were selling at the equivalent of $0.70 to $0.75 a pound, compared with a United States buyer's ceiling price of $0.62 a pound at the ports. Local observers are of the opinion that, although increases in the ceiling might have increased United States purchases temporarily, the effect would merely have been to start an inflationary spiral.

War experience has pointed up the possible desirability of increased goat- and sheep-skin production in the bulge of Brazil to meet this new demand within the country as well as the returning export market. Expansion would add to the precarious income of the people of the interior.

With this end in view, the efforts of the State and Federal governments to improve the breeds through selection deserve encouragement. More aid could be given in the distribution of biological products and drugs for combating diseases and parasites. Better roads into the interior would facilitate transportation of hides and skins to the coast. More storage dams are needed to conserve water. Irrigation plans for areas near the São Francisco River, if put into effect, would make it possible for the people of the interior to grow food and feed for subsistence and help them to become permanent producers of these needed crops, as well as sheep and goats, despite droughts.

ALONG THE *Agricultural Front*

▲ Peru to Increase Rotenone Output

Peru, which has been supplying the United States with a large percentage of its supply of rotenone during the war years, is planning to increase future production. Indications point to an annual production of more than 7,000,000 pounds of barbasco roots, from which rotenone will be obtained. This would more than double Peru's output prior to Pearl Harbor, when the United States was importing about half of its rotenone from the Far East.

Since 1942, Peru and Brazil have supplied the United States with nearly all of the rotenone that is now being used as an insecticide in agriculture. Last year Peru supplied 5,919,067 pounds of crude and partially ground roots, and Brazil furnished 598,631 pounds. Smaller amounts from Colombia, Venezuela, Ecuador, Trinidad, Tobago, and elsewhere brought the total for last year to 6,834,292 pounds.

The Peruvian rotenone industry is centered in the Upper Amazon area. Shipping, through the port of Iquitos, has increased rapidly. The increase in demand has occurred largely within the last 15 years, when demands of the United States for rotenone as an insecticide provided an increasingly big market. A 4-year agreement between the United States and Peru, signed in 1942 and providing sufficiently attractive prices, stimulated expansion of the industry to help supply the United States market.

Experiment stations and technicians of this country have been cooperating with Peru and other American Republics to increase the production of rotenone. More than 2,000,000 derris cuttings have been distributed in Mexico, Haiti, and Central and South America.

▲ Chilean Mission Studies Wine Markets

By Presidential decree a special mission has been appointed in Chile to promote the sale of Chilean wine-grape products in the Americas. The members of the Mission will visit the various American countries concerned to ascertain the present situation and report to the Government concerning possible negotiations for commercial treaties or special agreements by which Chile may expand its markets.

▲ Panama Establishes Food Inspection Bureau

The Government of Panama has established a Bureau of Food Inspection under the direction of the Ministry of Labor, Social Welfare, and Public Health. The new Bureau will maintain a control of sanitation in the manufacture, importation, and sale of all foods and drinks, verify weights, measures, and selling prices, and determine the nutritive value of dietetic specialties. Measures are being adopted to control permits for importation of food products and certificates of sale for local food industries.

RIVER BASINS

(Continued from back cover)

lands. These levees are preferred for many crops because of deep deposits of alluvium having remarkable fertility. Most of the bananas of Tabasco are planted in such locations. During the rainy season the river banks are better drained than the land lying farther back.

Behind the river banks, loams and clay loams, with clay subsoils, predominate. These areas are subject to long periods of inundation. They are, however, very fertile and, if properly drained, produce such crops as sugarcane successfully. In some of the foothill regions are fertile black loamy soils.

In contrast to Tabasco the topography of Chiapas is marked by a very narrow Pacific coastal plain, two well defined mountain ranges, a central valley, and a broken highland country. In some southern portions of the mountain ranges are peaks reaching 10,000 feet. A continuation of this rough, dissected region into Guatemala gives rise to the river systems of Chiapas and Tabasco. A sizable portion of the soil in this upland area is of volcanic origin.

Climate

The name Tabasco translated means damp earth, according to the people of the State, and appropriately so, for this region has the heaviest, most evenly distributed rainfall in Mexico. August marks the beginning of the greatest period of precipitation, which lasts until January. At no time during the year is there a prolonged dry season, although rainfall is smallest in March and April. During all months of the year the vegetation remains green and luxuriant.

On the coast the usual annual rainfall is about 45 inches. Inland 60 miles at Villa Hermosa, the capital of Tabasco, the average yearly rainfall has been 83 inches over a 20-year period. Teapa in the foothill region has a rainfall exceeding 200 inches in certain years.

From September to March, strong northerly winds sweep in over the coastal plain. These are termed northers and during the height of the windy season in November and December they occur as often as 7 to 10 times a month. Heavy rains accompany the winds causing the rivers to overflow their banks. At times as much as one-fifth of the total area of the State, 2,000 square miles, is inundated for brief periods. During these winds great damage is apt to result to banana plants which have had their roots loosened by floods and rains.

Again in contrast to Tabasco, the Valley of Chiapas has a distinctly different climate. Hemmed in by two mountain ranges, the Valley has a less humid, subtropical-to-

temperate climate. In some parts of the upper valley a yearly rainfall of about 30 inches is not uncommon.

Agriculture

In Mexico, the words bananas and Tabasco are practically synonymous. Virtually the entire economy of the State has been based upon the cultivation of this one crop. The first Gros Michel bananas were planted on the banks of the Grijalva by Manuel Jamet about 1880. Commercially the banana industry dates from 1906, when the first stems were exported to the United States. Completion of the deep-water canal at Alvaro Obregon 22 years later permitted large vessels to enter the Grijalva and move upstream to load fruit. For the next decade the industry boomed, almost 7 million stems going to foreign markets in 1936.

In 1937 the picture changed. The leaf-spot disease, sigatoka, was first noted. In 4 years sigatoka literally wiped out the Tabasco banana industry. In fact, in 1941 not a single stem of bananas was exported. Measures to combat the disease were established in late 1942 when a spraying program was begun. While the program has been reasonably successful, lack of shipping facilities and difficulties in obtaining spraying machines and chemicals have hindered progress. Tabasco, however, appears to be on its way again toward regaining its former position as an important exporter of bananas.

Tabasco is the sixth-ranking producer of rice in Mexico. Because of ample water supplies and available land resources, rice may become more important. From the coconut palms lining its coast, the State produces the third-largest quantity of copra in the Republic. Tabasco grows the customary Mexican crops of corn and beans for its own use. Tobacco grown near Huimanguillo is of excellent quality. Tropical fruits are found growing over a widespread area. Zebu and cross-breed cattle are grazed on pasture lands near the coast. From the higher foothill country coffee is exported. Cacao is produced for domestic consumption.

Castilla rubber created widespread interest in Tabasco and Chiapas at the turn of the century. The boom, however, was short-lived, and this type of rubber is now of minor importance economically. The forest products of Tabasco are well known, mahogany probably being the most abundant. Chicle is obtained from stands of wild sapote trees.

In the Valley of Chiapas the chief crop grown is corn, which is often interplanted with beans. Cattle are pastured on the natural savannahs of the Valley. Small quantities of wheat are produced in the higher, more temperate lands. On the mountain slopes on either side of the Valley, coffee is harvested. Smaller quantities of oilseeds, vegetables, and fruits are produced. Coffee, perhaps, is the only significant export from the Valley of Chiapas. Generally speaking, farming in this region is for local subsistence.

Deep in southern Chiapas live the interesting Lacandon Indians. Now few in number, and diminishing, this tribe traces its ancestry back to the Mayans. Living in a densely forested area traversed only by secret paths, their contact with the outside world is limited to an occasional stray traveler. They are hunters and farmers, practicing a rudimentary type of agriculture. In jungle-hidden ancient cities, some 1,500 years old, they still pay reverence to their Mayan gods.

Although the river system of Tabasco is the principal means of communication, the Grijalva in Chiapas is mostly too shallow even for small craft. Because of the heavy rainfall in Tabasco, most roads are impassable for several months a year. A new railroad is being pushed to completion, but because of the swampy nature of the coastal plain the project is moving slowly. Even with the railroad and more roads, the vast network of rivers will probably remain the most important avenues of transportation in Tabasco.

CINCHONA INVESTIGATIONS

(*Continued from page 32*)

Short stocky seedlings are not cut back, but the foliage is trimmed to approximately a half of its original surface by removing half of each leaf. Experiments are now in progress to determine the optimum amount of pruning necessary.

Plants are dug from the nursery beds in such a way as to disturb the roots as little as possible. Watering is usually necessary only at time of transplanting, because of the rainy season. Protection from the sun is given by placing the stems of several pieces of palm leaf around each plant, bringing the tops together, and tying them with the leaflets. This shade is not removed until the plants have recovered from transplanting and started new growth.

By the close of the 1944 planting season 4 acres of field plantings had been established, totaling about 7,500 trees. Recovery from transplanting was rapid, and indications are that this will be a successful area for growing cinchona in Puerto Rico. It is, however, too early to draw conclusions as to ultimate survival and growth. The two factors that make up production, yield of bark and alkaloidal content, are influenced by many factors, such as the plant's adaptation to particular climates and soils, its rate of growth, vigor, and resistance to insects and disease, and cultural methods used. The industry in Java was built upon the selection of high-quality strains and clones of cinchona. By selection and breeding of the present collection of strains and varieties in the Western Hemisphere, cinchona may be produced here that will be equal or even superior to that possessed by the Java industry before the war.

The Peacock Sheds His Tail, by Alice Tisdale Hobart. 360 pp. The Bobbs-Merrill Co., New York, 1945. This is a novel of international marriage between a young North American diplomat and the granddaughter of an old Spanish family in Mexico, owners of a large sugar hacienda. The story is closely woven with Mexico's movement toward democracy in the late 1920's and 1930's. "In it the peacock sung about in the ballads of the revolutionary soldiers becomes the symbol of out-moded luxury."

El Cultivo del Algodonero, El Crédito y la Organización Ejidal Colectiva en la Comarca Lagunera, by Armando G. Ulloa S. 270 pp., illus. Ministerio del Tesoro, Quito, Ecuador, 1945. This book by the Under Secretary of Agriculture in the Ministry of Economy of Ecuador is a study of the cultivation of cotton as it is carried out in the Laguna District of Mexico under a system of collective agriculture backed by the Crédito Ejidal National Bank. The study is intended to serve as a basis for an investigation leading, perhaps, to a similar system in Ecuador.

The Spice Handbook, by J. W. Parry. 254 pp., illus. Chemical Publishing Co., Brooklyn, N. Y., 1945. This is an informative guide to spices, aromatic seeds, herbs, and spice formulae. For each plant a picture, the plant name, family, places where it is indigenous and cultivated, description, properties and uses, adulterations, degree of grinding, and essential oil content of spices are given. Extracts from the Pure Food Laws of the United States and Canada and Provisions of the Spice Trade Association, as well as tables of distances and foreign weights, and a detailed index, are included.

Editor's Note.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

EXTENSION PROJECT

(*Continued from page 29*)

Often the only cash crop of a locality has been threatened by disease or by changes in world markets which have lowered the purchasing price below that which makes possible a living for the producer. Experimental work at the station in such a country has had to be done first to determine whether the crop will grow well enough there and with a sufficient yield and disease resistance to recommend it as a source of income for the people. Then the farmers must be made interested in the crop and aided in establishing it correctly in situations where it will thrive. This introduction of new crops which the United States needs not only aids us but gives a new lease on life to the farmers growing them.

Forage crops are important in the introduction and care of subsistence livestock. A number of these crops are being grown experimentally in the various stations to discover which ones are the best for each country. In one case, *Kudzu* has been the most successful, and a circular has been written introducing it to the farmers. In another country *Kudzu* was found not to grow well under the climatic conditions, and *Dolichos lablab* was recommended instead as an excellent forage crop.

The Long View

The list of subjects and ways in which extension work can aid farmers in the Latin American Republics is a long one. At all of the stations extension materials are now being distributed by staff members when they visit the farmers, or given to the farmers when they come to the station for aid or advice. Written materials, however, are at best but a supplementary help to that far more important aid, the full-time trained extension specialist, who, through close and continued association with the people and the use of demonstrations and personal teaching, can really understand and help to solve their problems. The extension work already under way is but the first small step toward that goal for which the world is striving, prevention of "hunger at the peace table."

AGRICULTURE IN THE AMERICAS — O. R. CARRINGTON, EDITOR

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Gifts of the Americas

THE PIÑON

by ELIZABETH G. MAGUIRE

Several years ago the rescue by airplane searchers of a group of Navaho Indians trapped without food or shelter by a blizzard in the mountains of New Mexico caused wide-spread interest. Neither the spirit of adventure nor the pleasure of a day's outing had lured the Indians to the mountains, but a regular journey to the forests to harvest an important item of food known as piñon nuts.

These little nuts, also called Indian nuts, pine nuts, and *piñones*, are the seeds of piñon trees, the only conifers in the Western Hemisphere that produce edible nuts of any importance commercially. Scattered thinly over thousands of square miles in the semi-arid regions of the Southwest and into the mountains of northern Mexico, these small spreading pines have been serving mankind for centuries. Many specimens of the nuts and objects made from piñon wood with its gum have been found in the rock shelters and amidst the ruins of the lands inhabited by the Basket Makers, those forerunners of the Pueblo civilization that flourished in the great terraced houses of a few centuries later.

Today the nuts are considered a great delicacy by Mexicans and people all over the United States. The tree provides excellent firewood and is used for fence posts, railroad ties, and charcoal. No other use, however, is as important as that of its seed for food.

Of the four species of piñon trees the *Pinus edulis* is the most productive. This tree bears incredibly large quantities of nuts every 5 to 7 years and smaller yields annually. It thrives in nearly all sections of the piñon forest range. *Pinus monophylla*, a single-leaf piñon found chiefly in the western part of the range, bears abundantly nearly every year. The Mexican piñon, *Pinus cembroides*, is widely distributed in Mexico but does not extend far north of the international boundary. The nuts are gathered and eaten on a large scale in Mexico. A four-leaf piñon, *Pinus parryana*, of little commercial importance, grows at high altitudes in southern California and northern Lower California.

The trees thrive at elevations of 5,000 to 8,000 feet, occasionally even 9,000, on moderate or on steep mountain slopes and over broad levels of sloping mesas. The best stands are found on coarse gravel, gravelly loam, or a coarse sand 5 feet or more in depth on which humus and ground cover are entirely lacking. Sometimes they grow on rocky areas where the soil is only 6 to 12 inches deep. The piñon is a hardy tree, more resistant to severe climate and disease than most of the conifers with which it is associated.

Harvesting begins as soon as the cones are opened by the first frosts and continues through the winter, as the snows remain only a short time on the sunny slopes. Large quantities are picked from the ground or found stored away by squirrels, but many of the cones are knocked from the trees with long poles and caught on tarpaulins spread below. Principally women, children, and old men engage in the industry. Each cone contains 2 to 30 seeds, with an average of 10 to 20. These seed-nuts average less than a half inch in length and run approximately from 1,200 to 2,000 to a pound. They are sold to local dealers by the *almud*, an old Spanish measure of 400 cubic inches containing 11 pounds. Two of the measures, or 22 pounds, are considered a good day's gathering, though some persons have gathered 40 pounds.

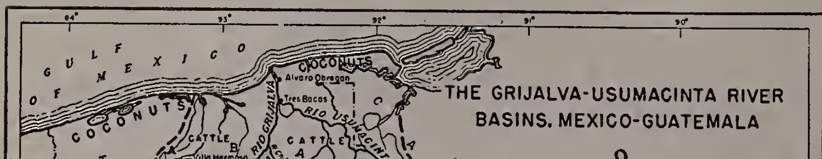
Besides being superior in richness and flavor, piñon nuts rank high in food value. According to food analysts a pound of unshelled nuts from the *Pinus edulis* tree contains more energy than an equal amount of most other nuts on the market. The percentage of shell is small. More than half of this tiny egg-shaped nut is edible nut meat having fat content of about 60 percent, an unusually high value among nuts.

Merchants, dealers, and native gatherers look forward to the coming of an abundant seed year and eagerly watch for signs of the approaching harvest. In 1936, a year of great abundance, the crop of piñon nuts harvested and sold in the States of New Mexico and Arizona was estimated at more than 6 million pounds. One small New Mexican town alone shipped 8 carloads, each containing 40,000 pounds.

Wartime conditions affected the industry. Many dealers report that the nuts disappeared from their counters nearly 3 years ago. At the present time, efforts are being made to restore the nuts to the markets, especially in the East where they had become increasingly popular. Soon again delectable cakes and candies will be filled with the enticing flavor of *piñones*, as the Mexicans like to call them, and mounds of delicious ice cream will be topped with the nutritious little kernels.

GRIJALVA-USUMACINTA RIVER BASINS MEXICO-GUATEMALA

by **Douglas M. Crawford**



Juan de Grijalva, Spanish conquistador, skirted the coastline of what is now the State of Tabasco, Mexico, in the early summer of 1518. He and his small expedition landed at the mouth of a large river, the first Europeans to set foot on Mexican soil. In honor of its discoverer the river was named Grijalva. The Grijalva, with its affluents and the Usumacinta, makes up the largest fluvial system in either Mexico or Central America. The State of Tabasco, in fact, consists largely of the 7,000 square miles comprising the delta of these two rivers.

The Basins

The Grijalva and Usumacinta have their sources in the Guatemalan highlands, and flow through the Mexican States of Chiapas and Tabasco, which lie just east of the Isthmus of Tehuantepec. On the slopes of the volcanoes of Tacana and Tajumulco, in the Sierra Madre paralleling the Pacific Ocean, the Grijalva has its origin. After winding and twisting through the Guatemalan highland country, the river enters Mexico at the upper limits of the Valley of Chiapas. The Grijalva slowly descends through the Valley for more than 130 miles before it turns and flows into Tabasco. In this region the river has been given several names, among which the Río de Chiapas and Río Grande are the most noteworthy.

When the Grijalva enters Tabasco, it is practically at sea level. On the flat coastal plain it is slow-moving, and launches can travel almost 75 miles above the town of Huimanguillo. In Tabasco a number of important tributaries enter the main stream, some of the largest being the Pihuacalco, Tacotalpa, Teapa, and Chilapilla. At Tres Bocas, 12 miles from the coast, the Grijalva unites with the Usumacinta, and they discharge through a common channel, passing the city of Alvaro Obregon. When the deep-water canal, constructed in 1928, is kept open at the mouth, ocean-going vessels can move upstream almost 45 miles.

On the Grijalva are located two important population clusters, which are the centers of economic activity. In Tabasco, Villa Hermosa is the principal center; Tuxtla Gutierrez, in the Valley of Chiapas, is the other.

The Usumacinta, the larger river of the two, also has its origin in the Sierra Madre, near the picturesque town of Quezaltenango. For a number of miles it forms the eastern boundary between Chiapas and Guatemala. Along with its tributary, San Pedro, it drains southeastern Tabasco. In Mexico the Usumacinta runs through a sparsely populated region. Thus it is less important economically than its sister river, the Grijalva.

Topography and Soils

Virtually the entire State of Tabasco is made up of a low-lying coastal plain on the Gulf of Mexico. Only in the extreme south eastern portion do low foothills begin to rise. Practically all of Tabasco lies below 200 feet elevation. The native vegetation is generally heavy, being composed of tropical rain forest and jungle.

On this alluvial plain the larger rivers have built up natural levees which are higher than adjacent

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March 1946

NAMES & NEWS

Sir John Orr Addresses Extension Workers

Sir John Boyd Orr, Director General of the Food and Agriculture Organization (FAO), paid high tribute to the U. S. Department of Agriculture in a recent address before the annual Extension Service Institute in Washington.

He pointed out that the USDA is not only the largest organization of its kind in the world but is, on the whole, the most advanced in the various fields of agricultural science. He felt a kinship, he said, with Americans because on various occasions when he was carrying on experiments or developing ideas in nutrition which seemed unorthodox he found that workers in the USDA were doing parallel work and getting similar results.

Sir John then outlined the development of FAO from its inception at the Hot Springs Conference in 1943. That conference, he pointed out, reached four revolutionary conclusions: (1) Malnutrition causes ills and premature death that can be prevented if people can get the right food. (2) Some two-thirds of the people in the world are chronically malnourished. (3) The chief cause of malnutrition is poverty. (4) Enough food can be produced for everyone; it is neither lack of knowledge nor niggardliness of nature that prevents us from doing it.

The objective of FAO is to determine the world needs for food and other agricultural products and then harness the productive capacity to satisfy these needs. The first step, which FAO is now undertaking, will be to develop a world statistical picture of the need for and the supplies of the principal products of agriculture, forestry, and fisheries. The next step will be to use these figures as a basis for recommendations to governments and to other United Nations organizations. Meanwhile plans are also being made to send a minimum number of missions of experts to the principal regions of the world to study possibilities for development.

Englund Addresses Canadian Farm Group

Eric Englund, Chief, Regional Investigations Branch, OFAR, recently was invited to address the Canadian Federation of Agriculture at London, Ontario. Dr. Englund spoke on the subject "World Affairs and the Farmer." In describing the world export and surplus situation after the present emergency period, he said in part:

"The United Kingdom, despite phenomenal wartime expansion in food production and an announced agricultural policy of maintaining high domestic production in the years ahead, is very likely to remain as North America's chief export market. It is evident, however, that the United Kingdom will import less than before the war. Moreover, Western Europe as a whole has reached the peak of population growth. Germany surely will not represent, for some time to come, a commercial outlet for the world's agricultural exports in anything like prewar proportions; and this may be true also of Italy and Japan.

"It may seem incongruous to suggest that the specter of agricultural surpluses, especially of food, may again stand side by side with the specter of hunger in the world of chronic underconsumption and actual starvation among a large part of mankind. 'Want in the midst of plenty' and plenty to the point of being burdensome to producers—that has been, and is, a great indictment of our age.

"The incongruous truth of the indictment, however, should stimulate us in the quest for remedial action, but should not blind us to the realities that confront the exporting countries and the farmers who are in a large part dependent on foreign markets."

●

Duncan Wall Succeeds Louis C. Nolan

Louis C. Nolan, after serving for 3 years as Chief of the Division of Foreign Information and Statistics, OFAR, left recently for Havana, Cuba. Dr. Nolan will serve as Assistant Agricultural Attaché under the Department of State. The new Chief of Information and Statistics is *Duncan Wall,* who came to OFAR from Farm Reports, Inc. He formerly served as Assistant Director of USDA's Office of Information.

Agriculture IN THE *Americas*

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Effect of War On Panama's Agriculture

Panamanian agriculture has been greatly stimulated by the war. A new Government program is emphasizing the production of food for home consumption and of new crops for export.

by KATHRYN H. WYLIE

Panama, the youngest of the American Republics, is traditionally a trading nation. During the war, and the months immediately following, however, more emphasis has been placed on agriculture. Food production has been increased substantially under Government encouragement, and a phenomenal expansion has taken place in the production and export of abacá fiber, known also as manila hemp. In the early years of the Spanish Conquest, this narrow finger of land offered a short route for transshipment of gold, silver, and emeralds from the west coast of South America to Spain. Since the construction of the Canal, it has served as a channel of commerce for the nations of the world. In spite of this emphasis on commerce and in spite of the fact that most of the food for the two large cities of the Republic as well as for the Canal Zone must be imported, more than half of the gainfully employed adults now make their living from agriculture, livestock, and fishing.

Resources for Production

The Isthmus of Panama, extending from east to west to connect the two American continents, is crossed by the 50-mile-long canal, which provides a vital link between the Atlantic and Pacific Oceans and influences the economy of the entire country. The land area of the Republic is approximately 28,000 square miles, not including the Canal Zone. Two mountain chains traverse the country from northwest to southeast to form the backbone of the S-shaped isthmus. Numerous rivers rise in the highlands and water the valleys and tablelands on their way to the sea. Many sections of these valleys and plateaus are adapted to some type of agriculture, mining, and lumbering, but by far the greater part of the agriculture of the Republic is in the provinces west of the Canal Zone. The soils of these agricultural lands are usually deep and fertile, composed largely of loam and fine sand.

Panama has the smallest population of all the American Republics, with two-thirds of its 632,000 people living on farms or in villages of less than 1,500 inhabitants. Urban dwellers are concentrated largely in the two cities, Colón and Panamá, located at either end of the Canal. Wartime construction and other activity attracted thousands of agricultural workers from the interior of Panama as well as from surrounding countries until these cities are heavily overpopulated. Commercial agriculture in the rest of the country has had to compete for labor with the high-paid city jobs.

The forest resources of Panama are relatively unexplored and unexploited. They include more than 50 species of valuable cabinet, building, and dye woods. Mahogany, Spanish cedar, maria, guayacán,

The author is an Agricultural Economist in the Western Hemisphere Division of the Regional Investigations Branch, Office of Foreign Agricultural Relations.

and cocobolo are commercially important. Tagua nuts or vegetable ivory, toquilla straw for making hats, copaiba, ipecacuanha, balata, and rubber are other forest products of value.

Much of the area east of the Canal is forested. Hardwoods abound in the highlands, and stands of mangrove, the bark extract of which is used in tanning, grow on the shores. Timber close to river transportation has been cut and taken to market, but back in the interior lack of transportation has preserved the virgin forest cover.

Pattern of Production

The three commercial agricultural products of any consequence are bananas, cacao, and abacá, all of which have been developed along the coasts. The principal food crops, which are rice, corn, yuca, plantains, sugar, and beans, are grown primarily for domestic use. Except for the three principal crops that enter foreign trade, production techniques are simple with little use of mechanized equipment The small farmer and his family cultivate their crops with hand tools and oxen. A common practice is to cut down and burn the forest cover on a small plot of ground, plant the land to crops for several years, and then move on to another plot. Little hired labor is used. Farm families cooperate in the work of clearing the forests and harvesting the crops through the *junta*, which is similar to a North American husking-bee party. The junta serves a dual role of getting the work done and providing a social contact.

Export Crops

Bananas ranked first in export value even during the war when shipments of the fruit were cut sharply by lack of shipping space. Exports reached a peak of 6,400,000 stems in 1938 but dropped to 945,000 stems in 1943 because of the war. Exports are picking up again as refrigerated shipping becomes available.

Although production of bananas is possible throughout the country, early commercial plantings were concentrated in the Almirante district of Bocas del Toro in northeast Panama and on the watershed of Gatún Lake near the Canal Zone. During the 1920's the Panama disease, a soil-borne fungus, destroyed so many banana plantations that portions of the lands on the Atlantic coast were planted to cacao and other crops, and by 1938 the banana industry had shifted to the Pacific coast. The Panama disease is not severe there, but Sigatoka leaf disease has attacked the banana plants, and spraying is necessary to keep this disease under control.

Until this past year cacao was the second-most-important export in terms of value, bananas and cacao together comprising from 85 to 95 percent of all merchandise exports. The United States takes most of this product, but other American Republics are taking increasing quantities. Before the establishment of a vegetable-oil mill in 1939, Panama was an important exporter of fresh coconuts. Since that year much of the production formerly exported has been converted to copra.

The product that has been influenced most by the war is abacá. Commercial shipments of the fiber began in 1942, and by 1944 had jumped to 22 percent of the value of all exports, surpassing cacao as the country's second-most-important export. Since 1900 attempts had been made to introduce abacá into the American tropics. The most successful experiment was started in the Republic of Panama where experiments showed that both climatic and soil conditions were favorable around Almirante on the northwest coast. The plantings flourished from 1926 through 1930 but were allowed to deteriorate during the depression. In 1937, however, a 1,000-acre planting was made and others in 1939 and 1940. These produced a good-quality fiber for export as well as seeds for use in neighboring countries. December 7, 1941, added impetus to the effort to produce this fiber so important as marine cordage, and early in 1942 arrangements were made for expansion of acreage in Panama and in other Central American countries. A large fiber-cleaning machine was installed at Almirante, new plantings were made, and commercial shipments began. So far, abacá developments in Panama have gone further than in any other country of the Americas—this in spite of the short supply of labor brought about by attractive opportunities in other occupations in the Canal Zone and other parts of the Republic. When abacá is again available from the Philippine Islands, the prewar source of most of this fiber, the Panama product will encounter competition in the world market.

Abacá production increased considerably under wartime demand.

In addition to the abacá, production of other strategic products was stimulated. Panama's extensive forests of wild Castilloa trees, as well as formerly abandoned plantation rubber trees, were tapped to provide rubber for the war effort. Experimental work with Derris, a plant containing the vegetable insecticide rotenone, proved valuable in providing cuttings for production elsewhere in the Hemisphere.

Food Crops

Rice is the staple food of the farm population, and the Government has taken more action regarding it than any other food crop. Production increased

Mahogany constitutes one of Panama's most important forest products.

sharply, until in 1943 only one-third as much rice was imported as in the early 1930's. Increased imports were again necessary in 1944 as a result of drought damage to the rice crop. Throughout the rural districts of Panama, as in other sections of Latin America, the brown-sugar blocks known as panela are consumed. White sugar is processed in the Republic, largely in the Province of Coclé. Potatoes, yuca, plantains, and beans round out a diet which is supplemented in certain areas by oranges, papayas, avocados, mangoes, and pineapples. Small quantities of Arabian-type coffee are grown, largely for domestic consumption, but some limited commercial production is carried on in the Province of Chiriquí.

Much of the foodstuff for the city population, however, must be brought in from other countries. Wheat flour, meat, dairy products, and fats and oils are the most important single items, although a great variety and quantity of other imported foods add to the local supply. Even with larger production during the past few years, increased population and purchasing power have called for more and yet more food from outside. The value of food imports more than doubled from 1939 to 1944, increasing from \$3,700,000 to \$8,200,000. Part of this increase resulted from higher prices, but much of it was accounted for by larger volume. Wheat-flour imports, for example, increased from 24,000,000 to 27,000,000 pounds, and evaporated milk from 1,400,000 to 5,000,000 pounds during the 3 years. Most of this food is imported from the United States.

The New Program

The interest of the Panamanian Government has been aroused to the need for larger food production and improvements in the lot of the small farmer. Although certain measures were taken before 1941, not until that year was a comprehensive program adopted. It provides for credit, direct purchase and sale of products by the Government where necessary, fostering of modern agricultural practices through extension and other educational facilities as well as provision of machinery and fertilizers, and price control and other regulatory devices.

One of the most important parts of this program was the establishment in 1941 of the Agricultural, Livestock, and Industrial Bank, known as the *Banco Agro-Pecuario e Industrial*. This Bank has encouraged increased cultivation through the extension of loans and control over production and imports. An initial 30-percent increase in cultivation of staple crops was planned, and a large irrigation project undertaken

(*Continued on page 56*)

Photo by Flatau

Panama has the smallest population of the American Republics, with two-thirds of its 632,000 people living on farms or in villages of less than 1,500 inhabitants.

Courtesy of H. F. Allard

The beautiful Turrialba Valley was selected as the site for the Costa Rican Cooperative Rubber Plant Field Station.

Cooperative Rubber Research In Costa Rica

Unsettled conditions in 1940 forced attention to sources and supplies of rubber. A Cooperative Rubber Research Station in Turrialba has been doing some interesting research, a report of which is given here.

by THEODORE J. GRANT

The importance and value of research for the successful development of a Hevea rubber industry have long been recognized. On the basis of research the extensive planting of rubber in the Far East was developed, and the lack of research contributed to the failure of early plantings in the Western Hemisphere.

At the beginning of the Rubber Investigation Project in 1940 the need for a Central Rubber Research Field Station for detailed studies of leaf blight and cultural practices under Western Hemisphere conditions became apparent. The important question was the location of the station.

Turrialba Selected

After careful consideration by E. W. Brandes, R. D. Rands, and Loren G. Polhamus, leaders of the project, the conclusion was reached that conditions present in Costa Rica seemed most suitable to meet the requirements. Their knowledge of specific field and laboratory needs of the research project and their long familiarity with lands and climate in the American tropics led them to select Turrialba and

Los Diamantes as ideal. Leaf blight had been found in 1935 in a small rubber planting at Turrialba and also in the more extensive rubber plantings of the Goodyear Rubber Plantations Company at Cairo, Costa Rica. Because of previous experience and cooperation in the study of leaf blight by that company and the United States Department of Agriculture, conditions were known to be suitable for the study of both leaf blight and cultural practices. The Atlantic coastal plain and slopes have a high rainfall well distributed throughout the year. There is a range of elevation from sea level to 10,000 feet in the area between the Atlantic coast and the top of Turrialba Volcano. The Pacific coastal plain offers opportunity to study rubber culture where there are distinct wet and dry seasons. Railroads, highways, and plane transportation facilitate the study of rubber culture under a wide variety of conditions with a minimum of time expended in travel.

The Costa Rican Government realized the importance of the work to be undertaken and offered its full cooperation. A joint party of technicians representing the United States and Costa Rica completed a survey of Costa Rica in September 1940. Finally, Turrialba was selected as a desirable site for the Cooperative Field Station.

By June 1941 a formal cooperative agreement was completed. The Costa Rican Government subsequently purchased 80 acres of land near the town of Turrialba for the use of the Station. This town is 40 miles from San José, with which it has both highway and railroad connections. It is on the Atlantic slope at an elevation of about 2,000 feet and it has humid weather and long dew periods that are particularly favorable to the development of the South American leaf blight.

Courtesy of M. H. Langford

Many thousands of the young Hevea rubber plants died of disease at Turrialba.

In addition to the land at Turrialba, the Costa Rican Government purchased for the use of the Station an old abandoned banana farm known as Los Diamantes. This farm, which is on the coastal plain and can be reached by railroad, is considered representative of other farms in the *Línea Vieja*, or Old Line, area and is admirably suited to the culture of rubber.

Work Begun

In September 1940, under the supervision of H. F. Allard, a small rubber nursery was started at Turrialba with rubber seed secured both locally and from the Philippines, Honduras, and Brazil. By October 1941 when personnel were assembled, and organized operations and field tests began, one residence had been completed and two were under construction.

The Turrialba Station now has six houses and a well-equipped modern laboratory. At Cairo a guest house has been constructed for the use of technical personnel and for the many official visitors who have come to observe plantation methods and the collection of latex and preparation of smoked sheet rubber. At Los Diamantes the old farmhouse was repaired and tool and storage sheds constructed under the supervision of Wallace E. Manis and Edwin Padilla. Labor camps, with running water and sanitary facilities, have been built. Lumber used in the repair and construction work was secured through logging operations on the farm, thus reducing costs.

Rubber seedlings needed for rapid multiplication of selected plant material were scarce in the beginning. By 1942, however, the Rubber Station was well supplied with seedling material received from many sources. The Goodyear Rubber Plantations Company cooperated in the work of multiplying selected plant material. One shipment of rubber seed of particular interest came from Africa through the cooperation of Firestone Tire and Rubber Company,

Dr. Theodore J. Grant was previously with the U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering. He has spent over 8 years in Central America conducting research in tropical agriculture. He was Director of the Cooperative Rubber Plant Field Station at Turrialba, Costa Rica for 4 years. At present he is Agricultural Attaché for the U. S. Embassies in Costa Rica, Nicaragua, and Panama.

Courtesy of E. P. Imle

A well-equipped laboratory is maintained for technical personnel and official visitors at Turrialba.

and Eastern clonal seed came from the Philippines.

Plants from African and Philippine seed soon showed little or no resistance to South American leaf blight. These seedlings, however, formed an excellent source of fungus spores for testing seedlings and clones collected from other parts of the world.

Under Turrialba conditions, ideal for disease development, hundreds of thousands of plants died or became so badly infected that spray protection was necessary in order to keep them alive. In connection with detailed studies of the leaf blight, M. H. Langford, the pathologist on the Station staff, helped nature spread the disease to plants being tested for resistance by spraying the young leaves with water suspensions of disease spores.

Persistence, research, and the cooperation of many countries, companies, and individuals finally were rewarded. Certain of the clones obtained through cooperation of the Brazilian Government and the Ford Company, and some of the seedlings and selections secured through the cooperation of the Peruvian and Colombian Governments, were found to survive even the severest tests imposed at Turrialba.

Securing of plants highly resistant to the South American leaf blight made possible the turning of more attention to the problems of multiplication and distribution of this valuable plant material.

Problems Stimulated Research

Multiplication of selected rubber plants as clones is carried out ordinarily by means of bud grafting, procedures for which have been worked out in the Far East. Under Turrialba conditions, however, spores were produced so rapidly that even weekly spray protection of seedlings could not give perfect control of the leaf blight, and budding success was erratic.

Studies of methods of budding, and of selecting, treating, and packing budwood, undertaken by E. P. Imle, a pathologist and physiologist, and F. A. White, horticulturist on the staff, brought about valuable improvements in practices. In the first place it was found that, instead of waiting until the seedlings were three-quarters to an inch or more in diameter, which is the usual size used for budding in the East, younger seedlings of one-half inch or less in diameter could be successfully budded. This meant a considerable saving in spray materials and labor. Experiments proved also that by selecting budwood in the proper stage of growth and by ringing it 2 weeks or more prior to cutting, budding success could be improved greatly. This was especially true with budwood that was stored or shipped.

The importance of this discovery is more readily appreciated when one realizes that in the early attempts to ship budwood from one country to another the losses sometimes exceeded 90 percent of the buds shipped. In fact, for a period of 2 years, it was considered more practical to ship budded stumps rather than risk high losses in the shipment of the scarce and valuable budwood of selected clones. The shipment of budded stumps by air express, however, was relatively expensive, since each stump weighed 1 pound or slightly more. Now packages containing over 1,000 buds and weighing less than 40 pounds have been shipped successfully from Costa Rica to Brazil, Peru, Colombia, and other countries. Some of these shipments required 10 or more days from time of cutting to time of budding.

Although improvements in techniques facilitated

Courtesy of M. H. Langford

Some of the plants survived even the severest tests imposed at the Station.

the shipment of planting materials from Turrialba to countries to the south where the disease already occurred and quarantine restrictions were not necessary, the problem still remained of how to get budwood and stumps of selected disease-resistant clones into the disease-free countries north of Costa Rica without carrying the disease. Also there was the problem of sending clonal material in sufficient quantity so it could be multiplied in adequate amounts to meet the demands of field and nursery planting.

Procedures for surface sterilization of budded stumps and budwood were carried out and initial shipments of treated materials sent to quarantine plantings, where they could be watched under controlled conditions. The first of these plantings was made in the greenhouses in Washington, D. C., and subsequently in Florida, Cuba, and on an island off the coast of Honduras. From these quarantine plantings some important initial shipments of resistant budwood were successfully sent into the disease-free areas. The need, however, was far greater than the supply brought by these small shipments.

On the basis of experience gained the decision was reached that budwood of the resistant clones carefully surface-sterilized might safely be sent directly from Turrialba to Bluefields, Nicaragua, the nearest nursery planting in the disease-free area. The matter was explained to the Nicaraguan Government and permission for the shipment was given. Dr. Imle supervised the surface sterilization and packing, and Mr. White and a trained budder from the Turrialba Station accompanied the first shipments, remaining in Nicaragua to superintend the budding of this valuable material.

These initial shipments were successful. By the end of 1944 the clones had grown rapidly. Distribution of this disease-resistant and disease-free plant material to other countries to the north was arranged. During a recent trip the writer had the pleasure of observing the excellent growth that these disease-resistant selections were making in the healthy multiplication gardens at Trapiche Grande, Guatemala.

The development and testing of disease-resistant clones, and their multiplication and distribution, have been primary objectives of the Turrialba Station. In the process of this work, much has also been learned concerning nursery and planting practices that is of value to the cooperative rubber program in other countries.

The Turrialba Station has not had to depend solely on formal publications for dissemination of this information. During the past 3½ years the Station has been visited by people from every part of the Western Hemisphere. Many of these visitors have been high-ranking government officials and special representatives sent specifically to study the procedures employed. Others have been interested, directly or indirectly, in rubber culture in this Hemisphere.

Much information has been disseminated through extensive correspondence on problems and by special trips made by various members of the Station staff to neighboring countries to give technical assistance. Several members of the staff have transferred to assist the work in other countries: H. F. Allard in the Dominican Republic, M. H. Langford in Brazil, and Wallace E. Manis in Colombia.

Costa Ricans Aid Program

The President and other government officials of Costa Rica have aided the Cooperative Rubber Research Program in many ways. The Secretary of Agriculture, José Joaquín Peralta, and his predecessor, Mariano Montealegre, recognized the importance of successful rubber planting, especially in the coastal plains areas where old, abandoned banana farms are now being used by temporary small-farm tenants. Here small-farm rubber plantings have been initiated.

Costa Ricans on the Station staff who have greatly aided in station operations and assisted in the investigations are Edwin Padilla, Arturo Lizano, Edilberto and Enrique Camacho, and Salvador Gurdian.

Research Work Continues

Lack of research on plantation rubber problems in the Western Hemisphere was a chief factor leading to the loss of the opportunity for developing a lucrative industry during the period of rapid expansion in the use of rubber at the beginning of the present century. Now, initial steps have been taken to correct this previous deficiency. Disease-resistant clones suitable for top-working high-yielding susceptible clones have been obtained and distributed to countries in this Hemisphere interested in the establishment of plantation rubber. In addition to advances made by study of the South American leaf blight, * improvements have been made in the methods of selecting, treating, packing, and shipping of budwood. Knowledge is being gained in cultural practices best suited to various field conditions. Continued research work may be expected to yield results that will be of value not only to Costa Rica but to every other country in the Western Hemisphere cooperating in the rubber program.

* *See* "Science's Fight for Healthy Hevea," by M. H. Langford, August 1944, and "Hevea Budgrafting Improved," page 62, April 1944, *Agriculture in the Americas*.

Tagua bur clusters are about the size of a man's head. Each cluster is composed of sections, or carpels, each of which contains from 4 to 6 seeds or nuts.

Tagua

Have you ever wondered what the buttons on your coat were made from? The chances are that they were made from tagua nuts, which came from a tagua palm growing deep in the forests of Ecuador.

by WALTER R. SCHREIBER

Tagua palms are found in many densely forested regions on the Pacific coastal plains of Ecuador and in other tropical portions of the Western Hemisphere from Peru to Panama. We know the nuts as ivorynuts or as vegetable ivory in North America; in trade they are known as tagua. The species native to the western slopes of Ecuador are largely *Phytelephas aequatorialis* Spruce, now generally known as *Palandra aequatorialis* (Spruce) Cook.

This tree is not one of the botanical giants of the Amazon, like the Brazil-nut tree, but it attains a height of 20 to 30 feet and has leaves 10 to 15 feet long extending from the trunk, more or less in umbrella fashion. The trunks of young trees are large in diameter in proportion to their height, the reason for which is understandable when one considers the heavy weight they must support.

The male and female trees are rather easily distinguishable. In the male tree, which bears no fruits, the leaves stand almost erect in a heavy cluster, making it seem somewhat taller than the female tree, in which the leaves extend out to the sides. The flowers grow out of the trunk of the female tree at the

base of the spreading leaves. After pollination, the female flowers develop into a cluster of burlike fruits.

The bur cluster, connected to the trunk by a short thick fibrous stalk, somewhat resembles a cluster of chestnut burs, except that a full-grown tagua bur cluster is frequently as large as 10 to 12 inches in diameter. It may weigh up to 30 pounds or more and is awkward to handle because of the presence of barbs. The multiple fruit is composed of a number of sections, or carpels, each of which contains from 4 to 6 seeds or nuts. The nuts are nearly the size of hens' eggs.

Tagua is not commercially cultivated in man-planted groves but grows wild in the forests. The nut is edible in its immature stage and is eaten by various rodents, even by people on occasion. The endosperm gradually becomes extremely hard resembling animal ivory. The names ivorypalm and ivorynut come from this quality. Several superstitions concerning propagation of the tagua palm are prevalent in some sections. One is that if the palm is robbed of its immature fruit, it will never bear again. Another is that the tree will not grow if planted by man, or at least will not bear fruit.

This palm is a coöperative member of the botanical world in that it has fruit all year around in all stages of development. Nearly always there are burs waiting to be broken open. The growing time of a bur from blossom to harvest is, roughly, a year. The number of burs to a tree depends upon its age and the soil in which it grows. The average is probably about 20, although neither native gatherers nor landowners have much statistical interest in the average yield.

One of the uses of tagua nuts is in making buttons. Here the nuts are cut into slices preparatory to being sent to a button manufacturer.

Harvesting the Nuts

As the entire crop of all the tagua palms is never harvested, even on the haciendas in Manabi Province, Ecuador, no one could supply more than a wild guess as to what the total might be. Vast tagua-producing areas have never been fully explored. In others the collection is too hazardous, or transportation difficulties are at present insurmountable. The weather during certain seasons prevents bringing nuts out of the forest. Export demand and price form still another factor: if either or both are too low, few nuts are brought out.

Harvesting of tagua nuts is similar in many respects to that of Brazil nuts. A heavy percentage of the harvest in Manabi Province comes from forests on the vast haciendas, the balance being collected by native gatherers on public lands.

Through the kindness of the *hacendado*, or landowner, the writer was privileged to make a trip via mule into the tagua area on a typical hacienda in Manabi Province, Ecuador. The estate, comprising about 185,300 acres, was an original Spanish grant to the present operator's forebears and has been handed down from father to son. It extends from a point on the beach of the Pacific Ocean eastward as far as a man can ride a horse from sunrise to sunset, then north another day's ride, and west still another day. This was a Spanish method of granting land to favored sons settling in the New World. The grant is as large as many counties in the United States and is extremely varied in soils and topography. The land extending from the ocean is level and sandy for about a mile. This portion is used for pasture and for the building site. The land then slopes upward for perhaps another mile, and the soil is dark and rich. Here the crops are cultivated.

The tropical jungle, which starts some 2 miles in from the beach, as do the hills, is similar to the jungle in Amazonas—considerable moisture, semi-twilight, and dense vegetation, making almost a botanist's

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heaven. Before we were out of the jungle on the return trip, darkness set in and we became temporarily lost. The *hacendado* admitted that he had never been over his entire estate, although he was born and reared on it.

The tagua palm trees on this estate are found in the jungle, and we observed how the nuts are actually collected. Native laborers, usually Indians or persons of mixed Indian-Spanish blood, live either near the main house or in shacks along the trails into the jungle. When not employed in other work, they take mules, baskets, or sacks, and the inevitable machete and start up the trail to the first tagua palm. The mules are tied to a convenient tree, mature burs cut down with the machete, and the burs broken to remove the nuts. When the containers have been filled with nuts, they are loaded on the mules and taken to the shack or to the hacienda. The gatherers never stay out longer than daylight permits, for they dislike being in the jungle in darkness.

On most estates in Manabi the collection of tagua is strictly a fill-in proposition, to keep laborers employed when not busy on other crops. The number of people employed in the industry, therefore, varies directly with the available time and demands of other crops. When sufficient nuts have been collected to make a trip worth while, they are sacked in burlap bags and transported to a trading center.

The *tagüeros*, or tagua collectors, who do not live on haciendas operate somewhat differently. Their lot is a hard one and not overly profitable. They operate either as a family unit or in groups of several families in the public domain. They use rafts or canoes, mules, and even their own backs to carry the nuts from the jungle to their camps and finally to a trading center. Their wordly possessions, usually consisting of a machete, axe, a few cooking utensils, and food, are often obtained on credit from the trader, to be paid off in tagua nuts during the season. Malaria and other tropical diseases take a heavy toll.

The Nuts Go to Market

Trading centers are usually located at some strategic place, such as the junction of two or more streams navigable by canoes and rafts, or the junction of mule trails. After the trader has received a sufficient quantity of nuts and finds transportation, he sends them on to the export centers, where they are sold to exporters or processors. The trader usually has a limited working capital himself and is in debt to the exporter for the goods he has used in his trading.

Rafts of balsa and other woods are an interesting part of the tagua story. Native tagua collectors fell the trees and build the rafts some distance up the rivers. They vary in size, carrying up to 15 tons of nuts. The larger ones have some rough shelter for the raftsman, his family, and occasionally his dogs, chickens, and pigs. The native raftsmen are skilled in maneuvering the rafts down the rivers. The raft makes but one trip. When the cargo of tagua nuts is unloaded, the raft is usually sold to local sawmills, thus bringing additional income to its owner.

Direct export centers in Ecuador are Guayaquil, Bahia, and Manta. Esmeraldas in the north, while important as a collection center, generally ships tagua to the other ports by small coastal vessels for export.

Domestic utilization of tagua in Ecuador is relatively small. Except for a button factory in Manta, the chief use is for curios in the form of carved birds, Indian heads, and chessmen made by individual workers for tourist trade in Guayaquil and Quito.

Making Buttons

The nuts must be sawed into flat layers from which buttons can be made. They are brought to the plant and dumped in bins, from which they are carried by workers to the boxes of the sawers. The sawing machine consists of an electric motor and a rotary steel saw about 8 inches in diameter, with a small wooden

(*Continued on page 58*)

Tagua or vegetable-ivory nuts are about the size of hens' eggs. Lower right-hand nut has been cut in half.

Mexico and the United States Report on Agricultural Progress

The Mexican-United States Agricultural Commission, holding its third meeting in Mexico City, takes stock of mutual progress made through many cooperative projects.

by JOHN A. HOPKINS

The third meeting of the Mexican-United States Agricultural Commission was held in Mexico City in December 1945. This Commission is composed of members of the Departments of Agriculture of Mexico and of the United States, who meet from time to time to discuss agricultural problems of mutual importance. The first meeting of the Commission was held in Mexico City in July 1944. The second meeting was in Washington in October 1944.

Mexican members of the Commission attending the meeting were: Ing. Alfonso González Gallardo, Under Secretary of Agriculture; Ing Darío L. Arrieta M., Director General of Agriculture; Dr. Guillermo Quesada Bravo, Director General of Livestock Service; and Ing. Gonzalo González H., Director General of Rural Economy. American members present were: Leslie A. Wheeler, Director of the Office of Foreign Agricultural Relations; Philip V. Cardon, Administrator, Agricultural Research Administration; and J. Barnard Gibbs, Agricultural Attaché at the United States Embassy in Mexico. Señor Ignacio de la Torre y Formento, of the Mexican Department of Agriculture, and the writer, representing the United States Department of Agriculture, served as secretaries of their respective Sections.

Courtesy of Pan American Union

Mexico City was host to the third meeting of the Mexican-United States Agricultural Commission last December.

In the earlier meetings the Commission spent considerable time examining the cooperative projects already in operation between Mexico and the United States, such as the exchange of information between the Departments of Agriculture of the two countries, quarantines and inspections of livestock and of plant material moving from one country to the other, the rubber production program, and cooperative sugarcane investigations.

Committees Appointed

During the third meeting these earlier projects were again reviewed. In addition, several new cooperative projects were planned and initiated, and seven committees were appointed to carry on the various types of cooperative work until the next session of the Commission in 1946.

One of the most important of the permanent committees is concerned with interchange of scientific information, personnel, and students. This committee has already done much to maintain a continuous flow of information and of students and scientific personnel in both directions. The United States Section is assisting in the placement of agricultural students from Mexico in agricultural colleges of the

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Mexican farmers and their families often present colorful displays of fruit, vegetables, and other farm produce along the sidewalks of the villages and towns.

United States as well as making available to Mexico certain of the services of the United States Department of Agriculture.

A second important committee is charged with facilitating cooperative work in the improvement of crops and livestock. It will keep informed regarding progress of present cooperative activities of this type and plan for the establishment of new projects. One subject discussed at some length was the certification of seed for export from the United States to Mexico, so that Mexican purchasers of seed would be assured of proper germination and freedom from weed seed or other foreign material.

Both countries are interested in keeping out plant and animal diseases, and a committee was appointed to study plant and animal quarantine regulations and arrangements now in effect between the two countries. Rather large amounts of agricultural products are exchanged between the two countries each year, and the plant quarantine authorities of Mexico and the United States are working together to prevent the entry of insect pests and of plant diseases new to either country. At the same time, livestock authorities are interested in maintaining regulations which will permit the entry of desirable livestock from abroad, particularly of breeding stock, but which will keep out foot-and-mouth disease and protect tick-free zones both in the United States and in Mexico.

It was reported by another committee that, since the second meeting, cooperative economic studies have been completed on the production, trade, consumption, and prices of cattle, henequen and istle, chick-peas, and fresh vegetables. Each of these commodities is produced in Mexico and is exported, to some extent, to the United States. The Mexican Section of the Commission was also interested in initiating promptly a similar study of cotton.

A fifth committee has been planning and carrying on studies of methods of improving rural life, especially in the lower income groups. Governmental agencies in the two countries have followed rather different methods of approach to this problem. Each country, however, has developed methods that are likely to be helpful in the other. During 1945, members of this committee visited a United States project at Taos, New Mexico, and inspected the work being done in several *ejido* communities at Santiago Ixcuintla, in the

Typical rural Mexican village in the Toluca Valley between Mexico City and Guadalajara.

State of Nayarit, Mexico. In Mexico, interest centered about educational methods used by Rural Missions in raising the level of living of the *ejido* families. Studies are now being planned in typical areas in both countries to test the usefulness of some of the methods observed.

A sixth committee was set up to confer on methods used in collecting agricultural statistics. It will meet shortly in Mexico City to develop statistical programs for the two countries.

Finally, a seventh committee was appointed to consider measures for the conservation of agricultural resources, including soil conservation and irrigation methods.

Mexican Projects Visited

Following the sessions in Mexico City, the Commission was invited, as guests of the Mexican Government, to visit agricultural projects located between Mexico City and Guadalajara. This trip, which required the greater part of a week, included the inspection of soil conservation and irrigation projects, and various other types of experimental work. The United States members of the group came away with a much better understanding of the problems of Mexican agriculture, and with warm memories of the open-handed hospitality of their Mexican hosts.

Discussion at the conference and on the inspection trip brought out again the fact that there are many subjects of importance to farm people in the two countries which require cooperation if they are to be solved in a satisfactory manner. Results of the three conferences held to date have been substantial. Even though not spectacular, they have laid a firm foundation for future agricultural collaboration that will certainly be beneficial to both nations.

PANAMA'S AGRICULTURE

(*Continued from page 46*)

in the interior. Temporary revisions were made in tariff duties to permit increased food imports. During the war the Government was authorized to take over private property suitable for agriculture and issue temporary licenses for its cultivation. Late in 1943 the National Institute of Nutrition was established to make recommendations to the Government on specific problems relating to nutrition, agricultural and industrial production, marketing of foodstuffs, regulation of consumption, and other important problems pertaining to the life of the people. Largely because of the Government's efforts food production has increased above prewar levels. Other aids to agriculture contemplated by the Government include improvement in transportation, and the construction of granaries, warehouses, grain elevators, and refrigeration plants for storing and conserving the products of agriculture.

War-Born Problems

The war has been responsible, either directly or indirectly, for Panama's reduced exports of bananas and cacao, the increased Government stimulation of food production, transfer of workers from the farms to the cities, the rising demand for food, and the greater emphasis on the development of strategic commodities.

Postwar Panama will, doubtless, continue to be a trading center tied closely to the Canal Zone and, in turn, to the economy of the United States. Bananas probably will dominate the export market and compete for land now devoted to other crops. For years Panama has been one of the deficit food countries. Even with the intensified program of expanded food production, it probably will need imports from abroad for many years to come. To the extent that the Government's program contributes toward more adequate internal transportation facilities, improved methods of cultivation and harvesting, and the establishment of irrigation, it will improve the basic agricultural economy, although such shifts in the agricultural pattern will be slow. Now that the war is over, a great number of people working in the cities on activities connected with the war may be out of work, but may not wish to return to the subsistence farms from which they came. The resulting unemployment problem with which the Government will be faced may retard progress in agricultural development. On the other hand, availability of machinery, insecticides, and fungicides will operate in the opposite direction.

Production of rubber and a few other strategic products for export may continue for some time after the war, but the long-run prospects are uncertain. Panama seems particularly suited to the production of abacá. Yields per acre are high, and mechanical defibering adds to the efficiency of production there. Abacá seems to have a fair chance of remaining one of the principal export crops and may serve to absorb workers displaced from other activities to cushion the shock of reconversion from war to peace.

ALONG THE *Agricultural Front*

▲ National Institute Of Agriculture Created In Dominican Republic

A National Agricultural Institute has been established in the Dominican Republic by a Presidential Decree, the first agricultural college operating in the Republic since 1935. The Institute will be housed temporarily in buildings in the town of San Cristóbal, which is a short distance from Ciudad Trujillo, but permanent quarters will be erected as soon as a permanent site is selected.

The Institute will provide facilities for training students in scientific and practical agriculture, offering bachelor degrees in agricultural science and agricultural engineering. Although it is not a part of the University of Santo Domingo, preparatory courses may be taken there by agricultural students. Special short courses will be given for rural teachers.

▲ New Agricultural School at Belém, Brazil

By a recent Decree-law a new agricultural school to be known as the Agricultural School of Amazonia has been created, with its headquarters at Belém, State of Pará, Brazil. It is to be dedicated to the preparation of agronomists for the typical regions of the northern part of Brazil, but regulations will follow, for the present, those established for the National School of Agronomy.

The new agricultural school will be connected with the *Instituto Agronómico do Norte*, using all the facilities and equipment of the *Instituto* and operating under the direction of its director. A boys' dormitory is to be constructed on the grounds of the *Instituto* and the operation of the new school to begin gradually.

▲ São Paulo Emphasizes Agricultural Education

The program of rural education that was started 4 years ago by the State of São Paulo, Brazil, is now beginning to bear fruit. Of the five agricultural schools planned at that time, one is actually in use now and the others are nearing completion.

The new school is known as the Getulio Vargas School and is located near Ribeirao Preto. At present 105 boys are enrolled, but this number is expected to increase to about 300 in the near future. Although several of the buildings have yet to be completed, the boys are already living at the school and have begun their training.

Instruction will emphasize practical agricultural operations with sufficient knowledge of the three R's to aid the boys in carrying on the ordinary business transactions of the farm.

▲ Milk Pasteurization Plant Erected in Panama

A modern milk pasteurization plant with a daily capacity of 4,000 bottles is scheduled to open in David, Panama, some time this year. The new enterprise, said to have a capital of $50,000, was incorporated by a group of Panamanian businessmen. The pasteurization process will be a completely mechanical operation, with equipment coming from the United States. The plant is expected to start with a daily production of 3,000 bottles, which will be increased as the necessity arises.

▲ Chile Interested In Farm Machinery

Great interest in farm machinery was manifested at two important agricultural expositions held in southern Chile recently,. one at Osorno and the other at Temuco. Sales were high, with orders being taken for delivery 6 months to a year hence. Wheel tractors of several sizes and makes, track tractors, combines, plows, harrows, and grain drills from both United States and Canadian firms attracted great interest.

▲ Peru Works To Improve Agriculture

Peru's agricultural authorities and technicians from the Institute of Inter-American Affairs are working together through the *Servicio Cooperativo Interamericano de Producción de Alimentos*, known as SCIPA, to bring about full utilization of Peru's abundant agricultural, forest, and pastoral resources.

One project is the establishment of a machinery pool in the Huacho and Trujillo areas on the Peruvian coast. Machinery is rented out to many small farmers who could not afford to purchase and maintain individually heavy mechanized equipment. In this way the use of tractor-driven plows, and mechanical seeders and threshers is greatly increased. The Huacho-Trujillo experiment has received such enthusiastic support that plans are under way to extend the pool project on a Nation-wide scale.

Work is also in progress to increase and improve dairy and beef cattle production in Peru. More than 230 pure-bred animals, including 200 bulls, have been imported and distributed among Government experiment stations and private purchasers. Animal quarantine stations are under construction.

In order to increase Peru's food production and induce improvement in nutritional habits, 45,000 families have been assisted with technical advice and furnished seed for the planting of home gardens. As a result, many families now for the first time are growing and eating tomatoes, lettuce, cabbage, and a variety of other vegetables.

Catálogo de la Flora Venezolana, by H. Pittier, T. Lasser, L. Schnee, Zoraida L. de Febres, and V. Badillo. 423 pp. Volume I, No. 20 in the C. I. A. series prepared by the Committee on Organization for the Third Inter-American Conference on Agriculture, Caracas, Venezuela, 1945. This is definitely a catalog, including the Latin name, common name, habitat, and collection number of more than 6,000 flora species found in Venezuela. It starts with ferns and their allies (Pteridophyta) and goes through the Leguminosae, or bean family. Keys to the genera are given and, where possible, a key to the species has also been included.

Agriculture in Nicaragua, by José M. Zelaya. 43 pp., illus. Pan American Union, Washington, 1945. The Minister of Agriculture of Nicaragua presents this recent addition to the American Agriculture Series. In it he discusses various phases of agriculture in Nicaragua, including land tenure, agricultural areas, labor and equipment, farm credit, irrigation, agricultural production, trees, livestock, foreign trade, and agricultural education.

Cultivo del Caucho en la América Tropical, by R. D. Rands. 44 pp., illus. Pan American Union, Office of Agricultural Cooperation, Washington, D. C. This is a translation into Spanish of a series of articles which appeared under the same title in the 1942 June, July, and August numbers of the *India Rubber World Magazine*. The author discusses the cultivation of rubber on small fincas and large plantations, experiments in developing disease-resistant and high-yielding clones, projects carried on at various experiment stations, and such problems as inter-planting.

EDITOR'S NOTE.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

TAGUA

(*Continued from page 53*)

guard over a portion of the blade. A small device holds each nut as it is sawed. Since the nuts are so varied in shape and size, each must be handled separately by the workers, mostly girls and a few boys.

The hard nut slices are run through a sizing machine, consisting of a long steel cylinder having holes of various sizes, much like machines used in rock crushers to separate the different-sized rocks. The sorted slices are sacked in loose-mesh bags usually made of some local fiber and are then ready for export or sale to the button factory, where they are colored and shaped. Not all the nuts are processed in the country of origin. In fact, many thousands of tons are exported annually without being sliced.

Commercial Importance

The economic importance of tagua may have been discounted, from the manner in which the industry is handled. Among Ecuador's exports tagua nuts generally rank fifth in value. They became commercially interesting about 100 years ago, when a few were shipped to Europe and served as a substitute for the elephant ivory of Africa. In prewar years France, Germany, and other European countries bought large tonnages, though the United States was the principal buyer. In 1939 this country imported 6,225 tons, mostly from Ecuador. The factory said to be the largest in the world using tagua is located in Rochester, New York.

The tagua industry, like many others, has a somewhat uncertain future because of war-developed substitutes, especially for buttons. The tagua button is easily colored and retains its color well, but it is subject to breakage. During the war, when many countries were cut off from their sources of tagua nuts, synthetic substitutes were developed which in some cases appear to be more durable and cheaper to process. The extent to which these substitutes will replace tagua buttons in the postwar period remains to be seen.

AGRICULTURE IN THE AMERICAS O. R. CARRINGTON, EDITOR

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U. S. GOVERNMENT PRINTING OFFICE: 1946

ULÚA RIVER BASIN

(*Continued from back cover*)

Castilla rubber exist farther in the interior, in valleys of rivers flowing into the Ulúa. A promising Hevea rubber industry is developing under the guidance of U. S. Department of Agriculture technicians. One of the main rice-producing areas of the country is along the Ulúa River and its tributaries. Rice produced in the area from Puerto Cortés eastward to Tela and inland as far as Lake Yojoa is milled at Puerto Cortés. All the sugar produced is used locally. Cane is processed at the mill of San Pedro Sula, the only one now operating in the north-coast area. Citronella and the African oilpalm also grow here.

Coffee ranks second to bananas as an agricultural export, though its production is small in comparison to that of other Central American countries. It is cultivated chiefly in the States of Santa Bárbara, Gracias, and Copán, all drained by tributaries of the Ulúa, and in Choluteca on the Pacific coast.

Corn, beans, yuca, and rice form the staples in the diet of the people but are produced mostly for local consumption. Records of the Comayagua Valley Project show that with improved production practices and use of irrigation these crops could be produced the year round. Wheat and potatoes are grown at altitudes up to 4,000 feet. Some wheat is exported to El Salvador from the States of Gracias and Ocotepeque.

Although the Ulúa Basin is not the area of greatest livestock production, the industry is gaining popularity there. In the Department of Cortés livestock raising is next to bananas in importance.

Cattle usually are allowed to range and they exist on pasture alone. In some upland valleys shut away from rain-bearing winds pasture completely fails during the dry season. Many cattle are lost by starvation, and disease and insect pests cause heavy losses.

A few farms, particularly those owned by the fruit companies, maintain good herds by controlled and selective breeding. Pastures are irrigated during the dry season and pasturage is supplemented by forage and grain. As more of the farmers become interested in better care and feeding of their cattle, the industry promises to become even more important.

Honduras is so well forested that no one region can be designated a forest area as opposed to non-forest areas. As settlement and civilization have advanced, however, the stands of timber have been destroyed by cutting and burning. The rich groves of mahogany, guayacán, primavera, and other hardwoods which formerly grew in abundance in the tropical north-coast area have been greatly depleted. At present the best stands are in more remote interior valleys. Recent surveys have been made along the Ulúa as well as the Chamelecón, and mahogany is now being cut from the west side of Lake Yojoa to the Chamelecón.

Pine is by far the most extensive forest resource of Honduras, being found practically everywhere in the country, but the largest growths are as yet inaccessible. Cedar is found with mahogany and is usually shipped with mahogany logs. Balsa is exported in small quantities, largely as rafts to float mahogany.

Transportation

Honduras has much yet to do to develop its transportation facilities. An intercoastal highway of around 280 miles connects San Lorenzo on the Pacific with Potrerillos. This road is important to the commercial life of the Ulúa Basin, since it connects Potrerillos with the highland city of Comayagua. From Potrerillos the National Railroad, owned by the Government, runs through San Pedro Sula to Puerto Cortés on the Gulf. There are five other railroads owned and operated by the fruit companies which serve the banana lands of the north coast. The Río Ulúa and the Comayagua provide important river transportation and communication.

Cities

One of the principal Atlantic ports of the Republic, Puerto Cortés, is located a short distance west of the mouth of the Ulúa. San Pedro Sula is the center of the banana industry and an important distributing center for northern and western Honduras.

Of growing importance is Santa Bárbara, capital of the coffee-growing department of the same name. This little town has a unique industry, next to coffee its most important. That industry is the making of the famous *sombrero de junco*, a hat similar to the Panama hat. Its manufacture is carried on only in Santa Bárbara and in the towns within a 15-mile radius. Hats are woven from fiber brought down from the surrounding mountains. About 12,000 ordinary-type hats can be produced in a month. If one desires a finer hat, he must order it about a month in advance. It costs about $5.00.

Comayagua, ancient capital of Honduras, is a commercial link between the Ulúa Basin, Tegucigalpa, and the Pacific coast.

The Ulúa River Basin is probably the most favored area in Honduras. Most of the country's railroads are found there as well as the best highway. The seaports of the north coast provide access to world markets for much of the country's export trade. Climate and soil favor production of a wide variety of fruits, vegetables, and grains.

The fruit companies have done much to modernize and improve the agriculture of the lower Ulúa Basin. The new *Escuela Agrícola Panamericana*, sponsored by the United Fruit Company, though not in the Valley, draws students from that area and does work in agriculture there. Similar progress has been made by the Food Supply Mission's project in the upper part of the basin, near Comayagua. Use of modern agricultural techniques by farmers throughout the basin may provide small export surpluses of corn, rice, and other crops now produced for domestic consumption only. Adequate storage facilities, too, would insure a supply of foodstuffs, which, with more and better roads and railroads, could be distributed to more remote sections of the country and so raise the national standard of nutrition and health.

THE ULUA RIVER BASIN—HONDURAS

by Mary S. Coiner

In Southern Honduras are some of the highest ranges in this generally mountainous country. These ranges are much broken up by interior valleys and basins where spring the headwaters of numerous rivers which drain toward the Atlantic. Two of these—the Blanco and Comayagua—unite, near the town of Potrerillos, with the Ulúa, largest river in Honduras. The area drained by these rivers and their tributaries comprises about one-third of the total area of the country and is the center of its agricultural and forest industries.

The Comayagua, larger of the two branches, rises in the gently rolling Plain of Comayagua. Near the Guatemalan border, the Cordillera del Merendón almost completely encircles the Plain of Sensenti where the Río Jicatuyo, which becomes the Ulúa, has its source. The Río Grande de Otoro flows through the high fertile Valley of Otoro and joins the Jicatuyo north of Santa Bárbara. The Montecillos Mountain Range separates the Valley of Otoro from the Comayagua Valley.

Between the Comayagua and the Jicatuyo lies the principal lake in Honduras, Lake Yojoa. It is about 25 miles long, from 3 to 8 miles wide, and is closely shut in by high mountains. From its northern extremity the narrow, deep Río Blanco flows to join the Ulúa.

Climate

The low-lying level plains around the mouth of the Ulúa have a hot, moist, tropical climate characteristic of the whole Caribbean coastal area. Here is located the banana kingdom of Honduras, and coconuts, sugarcane, rice, grasses yielding essential oils, and some rubber are also produced.

In the high plateaus and mountain lands of the basin, at altitudes of 4,000 feet and over, the climate is similar to that of the Northern spring. Here most of the wheat, potatoes, and temperate-zone fruits are grown. Between these two extremes, at altitudes from 2,000 to 4,000 feet, a delightful moderate climate prevails and both tropical and temperate-zone crops thrive.

Agriculture and Forests

Of prime importance in Honduran economy is the banana. Honduras has long been among the three leading world exporters of bananas and has now begun to recover from losses sustained during the war. The banana industry belongs exclusively to the north-coast area, approximately 75 percent being located along the banks of the Ulúa River. Much of the land in this district is owned by a railroad, a subsidiary of the United Fruit Company, and thousands of independent producers also sell their crops to the company. Lack of technical knowledge and of capital with which to combat Sigatoka disease has caused many of the small banana producers to turn to corn, rice, plantains, and garden vegetables and to livestock raising.

Other crops besides bananas are produced in the low-lying plains around the mouth of the Ulúa. Coconuts are either shipped fresh or converted to copra, the proportion depending on relative prices offered. Throughout the coastal area, soil and moisture conditions are favorable to the cultivation of rubber. Limited amounts of wild

(Continued on inside back cover)

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NAMES & NEWS

L. A. Wheeler Talks To Horticultural Group

L. A. Wheeler, Director, OFAR, addressed the members of the Horticultural Industry Advisory Committee on Foreign Trade, at their meeting last January in Washington. He also served with C. W. Kitchen, Assistant Administrator, PMA, as Co-Chairman of the meeting.

Mr. Wheeler spoke on the Food and Agriculture Organization and its possible relation to foreign trade in horticultural commodities. Others from OFAR who appeared on the program included *Gustave Burmeister, R. B. Schwenger, George B. L. Arner, Oscar Zaglits, C. C. Taylor,* and *L. D. Mallory.*

●

Pendleton Assists With Famous Millionth Map

Robert L. Pendleton, Soil Technologist, OFAR, recently assisted the American Geographical Society in revising and correcting the Ecuadoran, Peruvian, and Central American sections of the Millionth Map of Hispanic America. The map is now complete and consists of more than 100 sheets, covering the entire Western Hemisphere.

●

Eric Englund Attends West Indian Conference

Eric Englund, Chief, Regional Investigations Branch, OFAR, at the request of the U. S. Department of State, attended the second session of the West Indian Conference, held at St. Thomas, Virgin Islands, the last part of February. Dr. Englund was adviser to Charles W. Taussig, who was Chairman of the Conference and Chairman of the Anglo-American Caribbean Commission. Representatives of British, French, and the Netherlands Territories in the Caribbean area also attended the Conference. The Commission has been broadened to include these countries and will hereafter be known as the Caribbean Commission.

Francis Flood Addresses National Farm Institute

Francis Flood, Associate Director, OFAR, attended the National Farm Institute at Des Moines, Iowa, in February, where he participated in a panel discussion on stabilizing agriculture through providing adequate markets for farm products at home and abroad.

Mr. Flood emphasized the importance of the value of imports to our national economy with the suggestion that exports are a means to foreign trade rather than the end. "One way to maintain our exports at reasonable prices would be through a system of international agreements involving the various commodities," he stated. "Such agreements could make it possible for the United States to have our reasonable share of the world market, and to have this share at prices higher than we would have if we followed unrestricted competition with other countries on a subsidy basis. These agreements, incidentally, could be directed toward expanding world trade and world consumption."

●

John B. Carpenter Goes to Tingo María

John B. Carpenter, Pathologist, Bureau of Plant Industry, Soils, and Agricultural Engineering, recently left for Tingo María, where he will carry on research on leaf blight of Hevea rubber in collaboration with the Peruvian staff of the Cooperative Rubber Station. En route to Tingo María Dr. Carpenter spent a month at the Cooperative Rubber Station and the Goodyear Plantations in Costa Rica, familiarizing himself with some of the disease problems and cultivation practices of rubber production in that country.

●

Samuel Work On 4-Month Tour

Samuel H. Work, Animal Husbandman for the Office of Foreign Agricultural Relations, is visiting Colombia, Panama, Costa Rica, Nicaragua, El Salvador, and Guatemala for the purpose of investigating feed problems in the production of complementary crops, and to make surveys in the animal industry field. He is visiting the various Cooperative Experiment Stations, the Institute of Inter-American Sciences, and the Canal Zone Experiment Gardens.

Agriculture IN THE *Americas*

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Colombian Cattle Transportation

Colombia is a heavy producer of cattle, slaughtering an estimated 1,250,000 annually. In their journey to market—on foot hundreds of miles over high mountain passes, or in boats down the Magdalena—the cattle lose greatly in weight and quality.

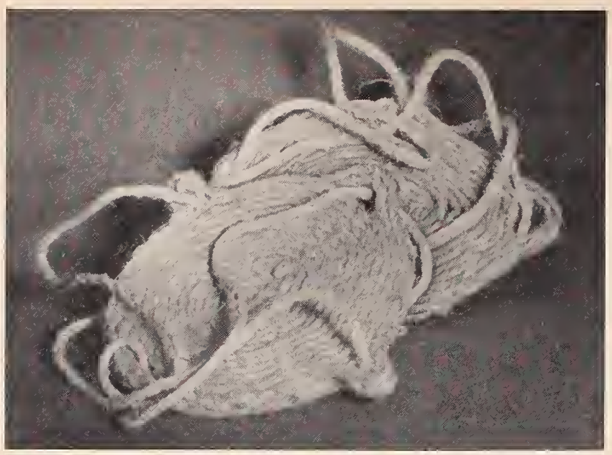
by JOHN A. HOPKINS

A week's time and a loss of 12 percent in live weight to move a herd of steers 75 miles; 6 weeks and losses up to 18 or 20 percent to drive them 250 miles! Such losses may appear incredible to United States cattlemen, but they occur regularly, every week in the year, in marketing cattle from the Llanos of eastern Colombia and from the broad pasture lands of the Magdalena and Sinú deltas.

Colombia contains about 12,000,000 head of cattle, and the annual slaughter is approximately a million and a quarter. The value of cattle production is exceeded only by that of coffee. Consequently, any serious difficulties involved and any excessive costs of transporting beef to market, either on the hoof or otherwise, are causes for widespread concern.

Partly because of climatic conditions, the calf crop is equal to only about 60 percent of the number of cows. Disease loss among young calves is high in some

Rugged mountain country such as this must be traversed by droves of Bolívar cattle on their way to upland markets.



Two pairs of ¾-inch-thick pads or shoes are provided for each steer that becomes footsore.

areas. In the lower-lying and warmer regions of the country there are fever ticks and various tropical diseases. And halfway up the mountains, en route to the upland markets, the cattle become infested with the young larvae of a type of warble known as *nuche*. A few days later the sides of animals are covered with welts, which turn into bleeding sores as the warbles emerge. Even with all of these difficulties, the Colombian cattleman has developed methods which are fairly successful, though primitive in some respects.

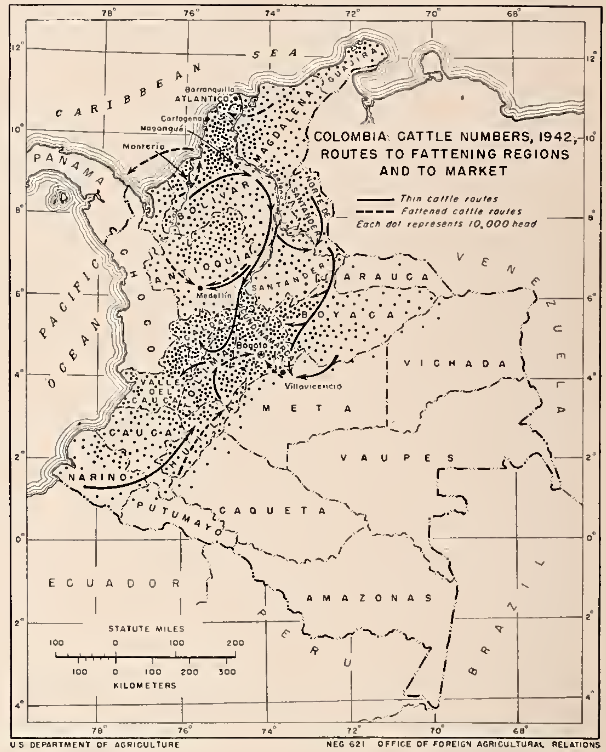
The problem that has been discussed most in the last few years, however, is not the tropical temperatures, the small calf crop, or the diseases, but rather the losses incurred in getting the cattle to market. It is not that cattle are affected more than other products. Cattle can at least walk to market from regions where transportation costs make it economically impossible to market many crop products. Neither is Colombia any worse off than most other South American countries, except that it has more and higher mountains than some of the others. It is merely that Colombian cattlemen are more vocal and determined to find cheaper and more profitable means of transportation than those now used.

From the Llanos to Bogotá

One of the most widely discussed cattle regions in Colombia is found in the great plains of the Llanos, which reach from Arauca Territory in the north through most of Meta and Vaupes in the south. From the Llanos about 40,000 head each year, mostly steers, are driven to Bogotá. Other herds move through passes in the eastern Andes to fattening grounds farther north.

To Bogotá the cattle are driven along a narrow motor highway which winds and twists from an elevation of 1,500 feet at Villavicencio, over a 10,000-foot mountain range. Then it winds down to Bogotá, at 8,700 feet.

Since the herds are continually meeting or being passed by trucks and automobiles, a relatively large number of drivers is necessary. One large cattleman said he sends 4 men with a herd of 40 steers. Six or seven days are required to Bogotá, and a total of 8



days is allowed to include time for the return trip to Villavicencio. The labor alone costs about 90 cents per steer for the 75 miles.

In addition to labor, it is necessary to pay corral rent each night. Frequently steers that have gone lame on the trip are hauled the remainder of the distance in trucks, and this involves a stiff charge. There is another expense which would sound strange to United States cattlemen—the purchase of shoes for cattle that become footsore but are still able to walk. These are ¾-inch-thick pads of braided fique,

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The author is Agricultural Economist in Charge of the Central and South American Section, Regional Investigations Branch, Office of Foreign Agricultural Relations.

the fiber of which coffee sacks are made. Two pairs are provided for each steer at the beginning of the trip, though the use of so many is seldom necessary. When expenses and incidentals are added up, it costs \$1.50 to \$1.75 per head to drive the cattle to market.

But the most serious cost is a 12-percent loss in weight and serious deterioration in quality of beef. The corrals provide water for the cattle but virtually no feed. Consequently, steers which weigh 900 pounds at the start lose approximately 100 pounds on the trip.

Loading Bolívar cattle on a Magdalena River boat.

Other products from the same region, such as corn and rice, also incur transportation costs that are proportionately as great if not even higher. The trucking charge from Villavicencio to Bogotá in 1945 was equivalent to \$12 per ton, while hauling in the opposite direction cost \$6.90.

From the Coastal Region Overland

The most important cattle-producing region in Colombia is along the Atlantic coast in the Departamentos, or States, of Bolívar, Magdalena, Atlántico, and La Guajira. The whole region contains an estimated 3,400,000 head. Bolívar alone has about 2 million. This Departamento contains the greater part of the Magdalena delta and the valley of the Sinú River, which is famous for its excellent pastures.

The cattle which are driven overland may follow any one of several routes, the most common ones converging on the highway where it crosses the Cauca River north of Medellín. Cattle are on the trail from 3 to 6 weeks, depending on their origin and the distance they have to travel. From the neighborhood of Monteria in the Sinú Valley, where the best pastures occur, 40 to 45 days are required. The cattle are driven slowly, stopping from time to time to pasture.

There is little pasturage south of the Cauca River. From this river valley the herds must climb over a mountain range more than 8,000 feet high and then wind down to Medellín at an elevation of 5,000 feet. Losses are naturally high, not so much in cattle dying along the way, as in loss of weight and quality of beef.

It is hard to say just what average or representative losses amount to. The cattle are bought and sold by the head, and there are but few stock scales in the cattle-raising region. Very high estimates are sometimes given. Steers leave the pastures in the coastal region in half-fat condition and weighing probably around 900 pounds. Estimates of losses up to 300 pounds have been given for the longer drives, such as those from the Sinú to Medellín. Perhaps 160 to 180 pounds loss per head is closer to the average. In any event, the steers arrive in Medellín extremely thin and then must be pastured nearby for 6 to 10 months to put them in condition. At recent prices, the value of the loss in weight on the trail was about \$12 per head. In addition to this, there is some death loss. Further, the cost of driving, plus pasturage, from the Sinú to Medellín is estimated at about \$6 per head.

Transportation by Cattle Boats

A second route to the interior utilizes cattle boats on the Magdalena River. From the Sinú about 12

Romo-Sinuano cattle are a blocky beef type, believed to have resulted from crossing the horned coastal cattle with the red polled.

days are needed to drive the cattle to Magangué, the principal cattle port on the river. Of course, less time is required from intermediate areas. From Magangué some of the cattle are shipped downstream to Barranquilla, which requires 1½ to 2 days, though the herds may need to wait 3 or 4 days for a boat. Other cattle are shipped upstream. Some are unloaded at Puerto Berrío and then shipped by railroad to Medellín. Shipping and driving charges by this route amount to about $10 per head, but loss in weight is estimated at 10 percent from the Sinú pastures to Medellín as compared with 18 to 20 percent when driven overland.

Still other cattle are unloaded at Puerto Wilches or are driven directly from Bolívar pasture lands and ferried across the river for fattening for the Bucaramanga market. Others are shipped by boat farther up river to La Dorada and are pastured in Tolima pastures for the markets at Girardot and Bogotá. On those which are finally marketed at Bogotá, river and railroad freight combined adds up to $13.25 per head for a total distance of 658 miles.

Cutting Transportation Costs

It would be hard to estimate just what the cost of cattle transportation amounts to each year. A bulletin of the Colombian Cattlemen's Association placed a valuation of over $500,000 on the annual loss in weight and quality of cattle driven from Villavicencio to Bogotá. A newspaper article in 1944 estimated that corresponding losses on cattle moving from the coastal region to Medellín amounted to $1,425,000 per year at existing prices. Probably these figures are somewhat high, but the loss is certainly great.

Considered as a percentage of value, transportation costs on crop products are even greater than on cattle. Since the cattle can at least walk to market, they provide a means of utilizing land so far from consuming centers that production and transportation of ordinary crops like corn, potatoes, or bananas would be economically impossible. Even by river and narrow-gage railroad it costs approximately $23 a ton to move wheat or flour from Barranquilla to Bogotá, a distance of about 450 airline miles, though much farther by the routes followed. Transportation by truck costs between 5 and 6 cents per ton-mile as a usual thing. There are many areas, however, that are not served by highways, and in these ordinary freight must be hauled either by pack animals or actually on the backs of men or women for short distances. A well-informed agricultural authority states that he believes it costs around 85 U. S. cents per ton-mile to haul produce by pack mules in mountainous country. A mule can carry only 200 to 250 pounds on the trails, and a man can handle about a half dozen mules. These can make a round trip of 12 to 14 miles a day and often return without a load.

At the end of the trail, in the Medellín cattle market.

Fortunately, Colombia is gradually extending its highways, and this movement will undoubtedly be speeded up as soon as more road-building equipment becomes available. Also, there is already a railroad from Bogotá to Barbosa, which is about half the distance to Puerto Wilches, on the Magdalena River. According to present plans, this is to be completed within the next few years.

About 150,000 cattle are driven each year to Barranquilla, Cartagena, and the many smaller cities within the area. Nearly as many are driven inland to the Medellín market and to fattening grounds, where they are finished on grass for other inland markets, including Bucaramanga, the cities along the middle Magdalena River, and even for Bogotá. In addition to these cattle, which are consumed within the country, about 20,000 head a year have been shipped to the Canal Zone during the war years to provide meat for this food-deficient area.

There are numerous dry-weather roads or trails in the coastal region, but during the rainy season they are impassable for anything except for men on horseback or for cattle on the hoof. In fact, large areas are covered with water, and cattlemen near the rivers must have two sets of pastures, one for the dry months when the best grass is in low areas, and another on higher ground for the wet season.

A highway already exists for about half the distance from Medellín to the coast. Extension of this road to Cartagena during the next few years is intended, but so far a couple of hundred miles of it exist only on

(*Continued on page 75*)

Courtesy of H. Hinrichs.

Farming From Sea to Clouds

Peru is almost like three different countries, so greatly do the towering Andes Mountains—home of Tupac and his llama—change the farming of the sections which they separate.

by OSCAR MOORE

Tupac obviously had overburdened his llama. The diminutive camel-like animal, which normally achieved an appreciable degree of sophistication by merely holding his nose high in the rarified Andean atmosphere, ceased sophisticating and commenced revolting. By defiantly settling to the ground he registered his revolt against the few ounces in excess of the usual load which had been heaped upon his back.

Tupac was an understanding Peruvian Indian, long accustomed to the antics of the llama. He proceeded to caress the animal cautiously, hoping thereby to get him back to his feet. In indignation, however, the llama slowly directed his head toward his master and ungraciously "spit" at him.

Disgruntled at this lack of respect, the Andean Indian stood and surveyed the valley below. He stuffed a bite of limed coca into his mouth and meditated his next move. Far below him spread the pink of the tiled roofs of Cuzco, situated upon an Andean plateau that lures many archeologists in quest of Inca, pre-Inca, and Tiahuanacu ruins.

This Peruvian countryside is rich in a great cultural heritage, that of the old intellectual Inca civilization, which was at its zenith some years before Columbus made his first New World landfall. To this was added the heritage gained from Mother Spain, after the Conquest, which bestowed upon Peru a colorful vice-regal status and a rich, abundant colonial life.

Today, through fine experiment stations, Peru is superimposing upon its simple life agricultural re-

Sheep thrive at high altitudes in the Peruvian Andes. Here are a few of the 14,000,000 found there.

search, modern cultural techniques, and improved distribution systems involving the radical change of direct transition from foot trails to airways. The new methods function beside primitive ones.

Altitude Dictates Climate

Peru is a composite of the entire South American Continent. It incorporates every climate found from the equatorial to the polar regions, because of a great range in elevation varying from sea level at the coast upward to Huascarán's summit 22,180 feet high. One ascends from sultry coastal desert with its numerous Nile-like river valleys, where cotton and sugarcane flourish, to the perpetual spring of mountain-enclosed tablelands, where maize and other temperate-zone crops grow, and finally to high summits, where winter is everlasting and the llama, vicuña, and alpaca abound under the protection of the world's finest fleeces. At each elevation, temperature is relatively constant throughout the year, with the seasons indicated, if nature bothers to indicate them at all, only by periods of dryness and rain.

Because of its geography, Peru is not one land but three. Whereas the United States has its East, South, Midwest, and West, Peru has its *Montaña*, *Sierra*, and *Costa*, all in a space only about twice as large as Texas. Each is the direct or indirect result of the formidable Andes Mountains, which traverse the length of Peru in parallel chains, forming a barrier down the middle of the Republic second only to that created by the Himalayas. Seven peaks exceed 20,000 feet. Much of Peru lies at elevations ranging from 12,000 to 22,000 feet and is inhabited chiefly by Indians, like Tupac. Not many of them live, however, at altitudes above 15,000 feet.

Until 1943, the only surface route between coastal Peru and the Amazon, or *Montaña* region, was by sea around the continent by way of either the Straits or the Canal and thence up the 2,000-odd-mile-long Amazon, navigable tributaries of which give access to the heart of interior Peru. Yet, the direct cross-country route from Lima to the Amazon Basin is only about 525 miles. In that year the Central Highway was opened, offering communication between Lima on the Pacific coast and navigable headwaters of the Amazon River Basin and giving access to Tingo María, Peru's unique interior experiment station. This highway crosses the Andes through a pass at an elevation of 15,700 feet, more than 1,000 feet higher than the loftiest mountain peak in the United States.

An American Egypt

The *Costa* of Peru is a narrow coastal belt, varying from about 25 to 100 miles in width. It embraces the Pacific ports, the famous cotton and sugar valleys, the rice and petroleum fields of the north near the Ecuadoran border, and Lima, the capital and chief commercial center. Commencing some 230 miles south of the Equator and forming a belt 1,400 miles long, the *Costa* is a desert, where rain seldom falls. The cold Humboldt Current, coming up from the environs

Barter is largely the method of trade in the southern Peruvian market places.

The author is an Agricultural Economist in the Western Hemisphere Division of the Regional Investigations Branch, Office of Foreign Agricultural Relations.

of Little America, chills the Pacific coast until a westward protruding isthmus in northern Peru deflects the current away from the Ecuadoran coast toward the Galápagos Islands. Millions of fish brought from the Antarctic by the current serve as a storehouse of food for birds that live on a chain of islands off the Peruvian coast. The droppings of these birds are deposited on the islands in such vast quantities that the guano serves as a source of rich nitrogenous fertilizer.

On the other hand, the Humboldt Current creates the coastal desert. The winds that blow inland are chilled by the current, even near the Equator on the Peruvian coast. The inflowing cool air is drying, and rain does not fall until the incoming breezes have been forced over the Andes. Hence, the desert is a cool, not a hot, one. At Callao on the coast mean monthly temperatures range from 62° to 71° F. Heavy clouds come in from the sea, cross the desert and humidify it, but seldom yield rain. Fog obscures the sun for weeks, especially in July and August.

Nothing grows on the sandy coastal desert except along the river valleys, where water, fed by the melting snow and by rainfall from atop the Andes, flows westward across the desolation. Some 50 rivers run down from clouded mountain ranges, but many of them never reach the sea, for the thirsty sands drink them en route. The continuous flow to the sea of about 2 dozen of the rivers constitutes the Egypt of the Americas. Each river valley is a miniature Nile and supports its own little civilization.

Cotton and Sugar From the Desert

Irrigation canals and pumps distribute the river water over about 740,000 acres in the coastal valleys for the production of two major crops, cotton and

Tropical plants such as these characterize the plant life of the *Montaña* region of Peru.

Courtesy of John Strohm

Sugar is one of Peru's chief export crops. An oxen-drawn trainload of sugarcane on a Pacific coast hacienda starts for the mill, where the cane will be ground and refined.

sugar, which are Peru's chief export commodities. Each valley supports well-to-do Peruvian families and large numbers of Indians who come down from Tupac's Andean world for employment. Sugarcane is the predominating crop of the haciendas of the north in the Piura-Chiclayo-Trujillo area; to the south, in the Huacho-Lima-Ica sector, cotton predominates. Since there are no well-defined rainy seasons, the valleys can produce cotton and sugarcane throughout most of the year.

In 1938, Peru's peak cotton year, 471,000 acres were planted to cotton, from which 396,000 bales were harvested. Since then cotton acreage has decreased between 20 and 30 percent, as food rather than fiber had to be produced during the war. About 85 percent of Peruvian cotton is of the wilt-resisting Tanguis variety, which was developed from a native cotton plant found in the Pisco Valley south of Lima. It gives a heavy yield, has a 1¼-inch staple, commands a premium price, and is especially useful for fine shirting, lace, part-wool textiles, and for various purposes requiring a strong staple. This variety is a perennial. It produces as many as three crops from one planting, the second crop usually being the best. Pima, an Egyptian type, and Acala, an American upland cotton, grow in the Piura region.

Sugar was Peru's foremost agricultural crop until outranked in importance by cotton in 1924. Approximately 396,900 short tons of sugar were exported in 1944. Sugarcane is grown on a large scale in Peru, involving the use of much machinery. About 70 plantations with plantings totaling 128,000 acres produce the entire sugar crop. The yield per acre is high, averaging 40 to 60 tons of cane and containing 10- to 12-percent sugar. About 500 gallons of water are re-

quired to produce a pound of sugar. The Peruvian Government strictly governs the use of water in an effort to give an equitable distribution of it. Measurements are taken of the quantity of water in the streams, and the water is rationed to each hacienda in proportion to its size. This explains why the profitable export crops of cotton and sugar are grown rather than the less profitable staple foodstuffs needed by Peru.

High Peru

The second part of Peru, known as the *Sierra*, varies from 4,000 to 20,000 feet in elevation, contains probably two-thirds of Peru's 7,000,000 inhabitants, and occupies about two-thirds of the Republic's area. This is the natural habitat of the Indians, who make up a large proportion of the Peruvian population. The gold, silver, copper, and vanadium mines, which constitute a major source of income, next to farming, are located here. The hidden valleys, the small, ancient, tile-roof villages, and the Indianfolk who live as their ancestors did centuries ago, still participating in the colorful *siembra* and *cosecha* fiestas, make this an interesting region.

Wheat, corn, barley, quinoa, and yuca are grown in High Peru. Potatoes, native to this region, frequently grow wild. Coca, the plant from which cocaine is derived, is indigenous to the eastern slope of the Andes. Production of tea is increasing in the vicinity of Cuzco, the old Inca capital, and in other localities. Research is under way to further tea production at the Tingo María Experiment Station.

The high country was estimated to have over 2,000,000 head of cattle in 1941. These cattle are essentially the same as those introduced by the Spaniards several centuries ago. They are small, slow-growing animals. They have not been improved by crossing with better types nor replaced by the latter, for such animals when brought into the region generally do not survive the 10,000-foot altitudes of the Andean grazing lands. Hides constitute the chief export commodity from these cattle.

Nearly 14,000,000 sheep are found in the southern Peruvian Andes at elevations as high as 14,000 feet. A number of large wool producers have flocks numbering several hundred thousand each. Most Peruvian wool, however, comes from small Indian flocks of unimproved sheep that give a small clip. Wool is produced also by the alpaca, llama, and vicuña, which live at very high altitudes on sparse herbage. More than 3,600 short tons of fine wool are produced annually by three-quarters of a million alpacas kept by the Indians. The alpaca has a fine long fleece that brings a high price because of great demand. The llama is customarily used as a beast of burden, as was Tupac's. It is capable of transporting a hundred-pound load under extreme altitudes.

Peruvian Jungle Frontier

The third part of Peru, known as the *Montaña* region, comprises the tropical forested eastern slopes of the Andes and the Amazon Basin. Most of the commerce of the area is transported 2,300 miles to the Atlantic through Iquitos on the Marañón River, which flows into the Amazon.

Civilization is penetrating the jungle from the *Sierra*. Colonization is under way along the new Central Highway, which leads down from the *Sierra* at Pucallpa and into the Amazon jungle, some 600 miles southwest of Iquitos. Scattered along the road are newly developed landholdings, most of which, because of the difficulty of clearing heavy forests with hand tools, display only a few cleared acres.

The highland areas on the eastern slopes of the Andes, overlooking the great orchid- and butterfly-filled tropical Amazon Basin, produce tea, coca, and barbasco. Along the riverbanks down in the basin proper rice and *chiclayo* beans, chief food crops of the Amazon, are cultivated. Where the flooding of the riverbanks permits a longer growing season, yuca, bananas, and sugarcane are produced.

On uncleared land along the rivers grow mahogany, rubber, and many other varieties of trees. Not much mahogany ever gets out of the region, however, because of the practically insurmountable transportation problem. Wild rubber trees along many rivers of the Amazon region have been tapped during World War II by Indians working in groups under the leadership of *patrones*. Other trees scattered in the jungle yield: Balata, which is a gum used for insulating telephone cables and for making golf balls; cinchona bark which contains the alkaloid quinine: and tagua, a palm nut from which buttons are made.

Most of the Amazon villages are located on uplands which, although seldom more than 200 feet above the rivers, are free from flooding. On these slightly elevated lands, corn, yuca, bananas, papayas, pineapples, sugarcane, coffee, and perennial cotton are produced. Barbasco, the rotenone-bearing plant, is grown as the chief export crop.

Peru is a land of bold contrasts, where farming is practiced from sea to clouds and down again to jungle interior. So different are the regions that the *Costa*, the *Montaña*, and Tupac's *Sierra* are almost three Perus.

Mexico's Istle Industry

Mexico has long occupied an important place in the production of fibers for world trade. Among these fibers are the istles—used in the manufacture of rope, twine, cordage, brushes, bagging, and upholstery padding.

by BEATRICE DU FRANE

Blessed with an unusually large variety of fiber-producing plants, Mexico is credited with having made notable contributions, since ancient times, to the development of uses for fibers and to the distribution of fiber-producing plants throughout the world. These fibers include istle, a hard fiber obtained from certain species of two unrelated plant families—the Amaryllis and the Lily. From these fibers, often called Tampico fibers by United States importers because Tampico served as their original point of shipment, are made brushes, upholstery tow, rope, twine, bagging, and cordage.

Description of Plants

Amaryllis Family: Fibers from the Amaryllis family are produced by two species of plants—lechuguilla and Jaumave lechuguilla. The fiber of lechuguilla (*Agave lecheguilla* Torr.) is known commercially as lechuguilla istle or Tula istle; that of Jaumave lechuguilla is known as Jaumave istle. Collectively the fibers of these two plants are often combined under the title of istle de lechuguilla.

The lechuguilla plant has no trunk above the ground and is composed of a cluster of rather thick curved leaves which range from 12 to 20 inches in length. The fiber is obtained from the young leaves, which make up the central bud or *cogollo*. At maturity the plant bears light-yellow flowers on a stalk from 5 to 7 feet high, after which it dies.

In appearance the second member of the Amaryllis family, Jaumave lechuguilla (*Agave funkiana* Koch and Bouche), somewhat resembles the common lechuguilla but its leaves are frequently straight and reach as much as 40 inches in length.

Lily Family: In the Lily family the fiber is produced by several plants. The most important of these is palma barreta, known commercially as palma istle. Palma barreta (*Yucca carnerosana* (Trel.) McKelvey) develops a cluster of leaves growing directly from the ground, then sprouts a trunk from 5 to 20 feet high.

Jaumave lechuguilla is similar to common lechuguilla except that its leaves are longer and yield a better fiber.

Palma barreta fiber is obtained from the young leaves forming the central bud, or *cogollo*.

Its leaves are thick, stiff, and rounded to a sharp point, and are from 24 to 44 inches long. On a flower stalk about 3 feet long the plant bears large cream-white flowers, and its pulpy fruit is edible. The fruit is consumed by both people and animals. As in the lechuguilla plants, the young leaves supply the fiber.

Another plant which produces istle fiber is the zamandoque plant (*Hesperaloe funifera* (Koch) Trel.). This plant produces 5- to 7-foot leaves which grow singly or in groups of 2 or 3 among creeping rootstocks.

A third plant that produces istle is palma pita (*Yucca treculeana* Carrière), also known as the Spanish-bayonet. It has a trunk from 3 to 15 feet in height, few branches, and thick pointed leaves from 35 to 50 inches long and up to 2 inches wide.

These palma fibers differ from lechuguilla istle in several ways. Palma istle fiber is softer than that of lechuguilla and is prone to rot rather easily, whereas lechuguilla istle offers greater resistance to both humidity and water. Collectively these plants from the Lily family are classified as istle de palma.

Where and How Istle Is Found

All of the istle-producing plants are native to and grow wild over a large area of arid and semiarid land in Mexico. None of them, except zamandoque, receive cultivation or irrigation. Lechuguilla is found in the area around San Luis Potosí and northward across the high tablelands of Central Mexico to southeastern Arizona, southern New Mexico, and western Texas. Jaumave lechuguilla is found in the State of Nuevo León and in the mountains of the Jaumave and Las Palmas Valleys in the State of Tamaulipas. Both lechuguilla and Jaumave lechuguilla are able to survive snow and frost. Palma barreta grows in profusion in the high mountain valleys near Monterrey and Saltillo, at elevations of from 6,000 to 9,000 feet above sea level; it is also found in the States of Nuevo León, Zacatecas, San Luis Potosí, and Coahuila. Palma pita is native to the States of Chihuahua, Durango, Coahuila, Nuevo León, and Tamaulipas, growing mostly in sandy soils. Zamandoque grows wild on sandy plains in the States of Nuevo León, Chihuahua, and Tamaulipas and is cultivated in Nuevo León.

The processing of istle fibers offers partial or entire cash income to many people. Harvesting and processing of the young fiber-bearing leaves of the common lechuguilla, Jaumave lechuguilla, and palma barreta are carried on in much the same manner. The central bud is removed first by means of an iron ring fastened to a handle about 4 feet long. This ring is slipped over the bud, or *cogollo*, and given a quick jerk, breaking off the entire *cogollo* but leaving a *cogollito* to produce a new bud. If the bud is from a lechuguilla plant, the edges of the leaves are stripped to remove the bordering spines; if it is from the palma barreta, it is steamed over a vat for 12 hours. The next step is identical for both plants, and consists of removing the pulp from the leaves. The pulp is scraped away from one end by drawing the leaves of the *cogollo* individually several times between a blunt knife and a block of wood. The cleaned fiber is then fastened to a piece of wood, and the other end of the leaf is freed of pulp, after which the fibers are dried in the sun. Jaumave fiber is 12 to 30 inches long, Tula is 8 to 14 inches, and palma is 8 to 30 inches.

Palma pita yields a coarse fiber after the pulp is removed from the leaves by scraping and beating. Steaming is sometimes resorted to, as with palma barreta, to soften the pulp. The leaves of the zamandoque, which are also steamed, are cut in half, because of their great length, and scraped.

Dried istle fibers, arranged in bundles, are marketed by truck or, in the more inaccessible regions, by burro.

Miss Du Frane is a member of the staff of the Office of Foreign Agricultural Relations.

Most of the fiber is sold in Saltillo, Monterrey, Ciudad Victoria, or San Luis Potosí.

Uses of Istle

The United States and Europe import considerable crude istle for various manufacturing purposes. About 98 percent of the Jaumave and lechuguilla and 10 percent of the pita and palma istles imported into the United States in 1942 were used in the manufacture of many types of brushes—whisk brooms, floor brushes, toilet brushes, dairy brushes, and various other kinds. The Tula, or lechuguilla, istles serve particularly well where coarse, stiff bristles are required, whereas Jaumave is used where high quality is of prime importance. During the war Jaumave and pita were in demand as a rope extender. About 90 percent of the palma and pita istles imported into the United States, and small amounts of other istle fibers, are used in the manufacture of cordage. Palma istle is used also in the production of unoiled twine.

Mexico manufactures many products from istle fibers both for home use and for export. This is carried on largely as a spare-time industry in the home, and most of the products are used locally. Many of the exported articles go to South and Central America, only a small quantity going to the United States. Coarse yarn is hand-spun from Tula istle and made into sacks or 2- and 3-ply rope. Palma istle is made into twine, sacks, brushes, and bagging to which a little jute has been added. Zamandoque and pita fibers find greatest use in the manufacture of twine, cordage, and sacking. One company in Mexico has developed a material which, if processed and mixed with latex, results in a versatile product useful in the manufacture of insulation, cushions, and floats. Istle waste, the only byproduct of istle fibers, is used as upholstery padding and in cheap twine. Recently Mexico has been emphasizing the export of dressed rather than of crude fibers to meet foreign demand.

A new bud starting after the old bud, or *cogollo,* has been removed from the lechuguilla plant.

Istle fiber is cleaned by pulling the leaf under a knife pressed against a block of wood.

Mexican Legislation Assists Industry

To control the production and export of istle de lechuguilla, Mexico in 1941 established a state-controlled organization known as La Forestal, F. C. L. Production of the fiber and, more particularly, its processing for the export market are encouraged through a small tax which is distributed to producers and those who process the fiber for export. Mexico has also established controls over the export of istle de palma. Permits for export are issued only if the exporter has sold to a Mexican fiber manufacturer an amount equal to that which he may wish to export.

USDA-34—A Tropical Sweet Corn

The development of a variety of sweet corn adapted to growth in the Tropics is a problem on which Experiment Stations have long been working. Here is an account of the result obtained at one Station.

by ROY E. HARPER

Sweet corn varieties commonly grown in continental United States have been tried often in the Tropics, but they are clearly not adapted to tropical conditions. Usually they make weak growth, maturing at 3 to 4 feet in height and producing few and small ears. The shorter day lengths of the Tropics as compared with those of the Temperate Zone during the growing season probably do not permit normal development of these varieties. Also, the continental varieties are susceptible to certain diseases, particularly Helminthosporium leaf spot (*Helminthosporium turcicum* Pass.) and Yellow Stripe mosaic.

In 1920 the Federal Experiment Station at Mayaguez, Puerto Rico, initiated a project with sweet corn in an attempt to produce a variety that was adapted to tropical conditions. In the first attempt Henderson's Sugar was crossed with a native variety of field corn. The hybrid was grown and selected for four generations and then crossed with another native variety and reselected through a few generations. The ultimate variety, however, was not so good as one discovered later.

In 1922 Thomas Bregger, plant breeder of this station, discovered in a field near Lajas, Puerto Rico, several ears of field corn which contained a number of kernels having some typical sweet-corn characteristics. It is not known whether the strain was the result of chance pollination from some variety of sweet corn grown in rural school gardens or whether it was a mutation from the native corn. Two years later Mr. Bregger left the station and turned the work over to Robert L. Davis, agronomist who tested the two types of sweet corn together and found the strain of pure native extraction to be superior to the selections from the previous cross made in 1920 with continental sweet corn.

USDA–34 sweet corn grows to a height of 8 or 9 feet in Puerto Rico and bears relatively large ears which compare in quality to the better continental varieties.

USDA–32 and USDA–34

Mr. Davis continued to work with the native sweet corn, crossing it back to native field corn, selfing and reselecting for productivity, tender kernels, and other desirable characteristics. By 1934 two varieties of sweet corn were developed and named USDA–32 and USDA–34. During the next 2 years the two varieties were grown in comparative tests.

USDA–34 proved to be the higher-yielding variety with larger ears and longer kernels. It was, therefore, selected for increased production and distribution. It is a vigorous tall-growing variety, averaging 8 or 9 feet in height and resembling somewhat the tropical varieties of field corn. This variety is highly resistant to Yellow Stripe mosaic disease, Helminthosporium leaf spot, and Stewart's disease (*Bacterium stewartii* E. F. Sm.) of corn and is somewhat resistant to damage by the corn earworm (*Heliothis armigera* Hbn.) because the ear develops a tight shuck which grows well beyond the tips.

This new variety compares favorably with such continental varieties of sweet corn as Golden Bantam, as judged by visitors from the North who have sampled it. Trial cold storage shipments of the corn were made to New York during the winter seasons of 1934–35 and 1935–36. These shipments were highly successful, and statements were obtained to the effect that the

quality of the corn was comparable to the best summer sweet corn produced in New Jersey and Long Island.

Distribution of New Variety

Since its distribution to growers in 1934, USDA–34 sweet corn has been extensively planted in Puerto Rico. Since 1936 the Federal Experiment Station has distributed from 500 to 2,000 pounds of seed each year for planting purposes. A substantial part of these seed distributions have been made to the Puerto Rico Reconstruction Administration, the Works Progress Administration, and Insular War Emergency Program for use in food-production programs. USDA–34 is about the only variety of sweet corn grown in Puerto Rico. Sweet corn has never become popular with the small farmer. This may be due in part to the fact that when small plantings are made near patches of field corn the sweet corn loses its identity after two or three crops as a result of cross pollination with the field corn.

The variety has been introduced also into other tropical countries and into some of the U. S. Southern States. In recent years it has been the only sweet corn variety recommended by the Hawaii Agricultural Experiment Station. It has performed well in Florida and Louisiana. It was tried in Arkansas, North Carolina, and Ohio and was reported to make excellent growth as compared with the northern varieties of sweet corn. Its late maturity, however, was objectionable. At the North Carolina Experiment Station it was found to mature approximately 3 weeks later than Golden Bantam or Golden Cross Bantam.

Seed distributions of this variety have been made throughout the Caribbean and to most countries of Latin America. Recently requests have also been received from several islands of the Pacific. It has met with such favor that a large continental seed company requested 20,000 pounds of seed for 1945. Military camps in Puerto Rico and on many islands throughout the Tropics have grown USDA–34 corn for corn-on-the-cob at mess tables.

The Federal Experiment Station has continued to improve the variety by selection for disease resistance, uniformity, and kernel tenderness. Recently, efforts have been turned to breeding a more vigorous and productive hybrid sweet corn, and several selected selfed lines of USDA–34 are now ready for further testing.

Mr. Harper was formerly Plant Geneticist, Federal Experiment Station, Mayaguez, Puerto Rico.

COLOMBIAN CATTLE

(*Continued from page 66*)

paper. There has also been perennial agitation for a railroad from the coast to the interior, and this construction was authorized in an act passed by the Colombian Congress in December 1945. So far, there are only two ways to get cattle to the interior. One is by driving them the entire distance, and the other is by driving them to the river and then shipping them at least part of the way on river cattle boats.

The railroad from Cartagena to Medellín will probably be built within the next 5 or 10 years. It seems safe to say that the saving on cattle alone will largely justify its construction. Very likely the highway will be completed first. Trucks traveling on an all-weather surface would permit a worth-while saving on shipments of meat as well as other produce from the coastal region to the interior.

Slaughter Plants To Save Meat

The new transportation facilities just discussed may take several years to complete. Meanwhile, the Colombian cattlemen do not intend to sit idly by awaiting developments. The Cattlemen's Association is out to make things happen more quickly. Likewise, smaller groups of cattlemen in the Villavicencio and Sinú regions are taking a hand, with the backing of the government-sponsored Industrial Development Corporation.

These groups are proposing to build two or three slaughtering plants near the pasture lands where the cattle can be fattened. One is to be at Villavicencio, another probably in the midst of the rich pastures of the Sinú. There may be a third somewhere at the base of the mountains where the cattle trails enter the Departamento of Antioquía before climbing over the Central Andes range on the way to Medellín. If the cattle can be slaughtered near the pasture lands, most of the loss of weight and quality of beef can be avoided. Further, the costs of hauling the meat to market in refrigerated trucks would probably be less than present costs of driving the cattle.

(*Continued on page 76*)

ALONG THE *Agricultural Front*

PAN AMERICAN DAY APRIL 14

April 14 is Pan American Day, a day set aside by the Governments of all the American Republics "to emphasize the bonds of friendship uniting the nations of the Western Hemisphere in one great continental community." The theme for this year, the sixteenth annual observance of the Day, is: FREE AND UNITED, THE AMERICAS GO FORWARD.

Teachers and group leaders may secure material and suggestions for programs, including school plays, music, motion pictures, and displays, from the Pan American Union, Washington 6, D. C.

▲ Peruvian Mission Studies Agriculture in Arizona and California

The increasing demand for food in Peru in recent years has concentrated attention upon the possibility of producing diversified food crops in the irrigated coastal valleys of that country. Most of the agriculture in that part of Peru has previously centered around cotton, sugarcane, and rice. Growers are faced with the problem of what crops can be grown to meet the need for food and at the same time furnish a suitable profit.

A committee of three was selected by the growers of the Cañete Valley to visit, last December, the agricultural areas of Arizona and California, where conditions are similar in many respects to those of the Cañete Valley. The trip was entirely a private enterprise, financed by the growers of the Valley. The purpose was to gain a first-hand knowledge of agricultural methods as applied to such crops as citrus, grapes, rice, potatoes, tomatoes, beans, corn, lettuce, and celery. Information was sought on everything, from the preparation of the seedbed through harvesting, processing, and marketing of the final product. Realizing the need for entomological assistance in the control of insect pests affecting miscellaneous crops, the committee requested that an entomologist from the Office of Foreign Agricultural Relations accompany the Mission and later aid in plans for the Cañete Valley project.

Cooperative farmers' organizations, experiment stations, the University of California, and various farm-machinery and seed firms cooperated in assisting the Mission to obtain the desired information. Under the guidance of authorities from these different organizations the committee inspected citrus groves and exchanges, rice plantations, vegetable farms, processing and packing plants, insect-control practices, and farm-machinery and seed supplies, and they attended round-table discussions.

The members of the Mission returned to Peru with a thorough knowledge of the problems involved in the introduction of new crops, the production and handling of farm produce, and marketing difficulties. They also were mindful of the importance of research and the role which research institutions could play in Peru if properly organized to conduct the type of investigations that would be essential to Peru's own particular problems.

▲ Animal Husbandry Institute Created in Brazil

In order to equip the Ministry of Agriculture with an organization especially responsible for carrying on research in genetics and nutrition as applied to domestic animals, Brazil has, by Presidential decree, created an Animal Husbandry Institute, which is directly subordinated to the head of the National Department of Animal Products in the Ministry of Agriculture. The objectives are to conduct research in genetics and breed improvement for domestic animals, animal nutrition, agrostology, poultry and rabbit raising, silk and bee culture.

The new Institute is charged with planning and coordinating all experimental work in the agrostology and nutrition section of the Institute of Animal Biology which is to be designated in the future as the Agrostology Experiment Station; the Breeding Experiment Station, the Poultry and Rabbit Breeding Experiment Station, and the Silk and Bee Culture Stations, located at Kilometer 47; the Breeding Experiment Stations at Desengano and Uberaba, together with the regional inspection posts at Pinheiral and São Carlos.

COLOMBIAN CATTLE

(*Continued from page 75*)

As was mentioned earlier, there is already a highway from Villavicencio to Bogotá. A large saving would be made by slaughtering the cattle at Villavicencio and hauling the meat, even at the present high charges for trucking.

From the coastal region to the interior there is as yet neither a highway nor a railroad. But the people of Bolívar are not easily discouraged. Recently, a group of Bolívar cattlemen were reported negotiating with an airline to haul the meat to Medellín by air. Perhaps this modern means of transportation will be used to save beef that is now lost on the trail, until other and cheaper means of transportation can be provided.

CUBA'S RIVERS

(*Continued from back cover*)

during long-continued downpours but not enough to have formed even faint drainage line depressions, although the annual rainfall is more than 50 inches.

Underground Streams

In those parts of the island which contain cavernous limestone much of the water finds it way into the subsoil and, in many cases, has formed underground channels through which it escapes to the sea. In certain parts, such as the region west of Jovellanos, streams rising in the higher part have formed channels for 10 or 15 miles and then disappear into the ground. Some of these underground streams reach into the sea, where the fresh water is forced up through the salt water to form the fresh-water boils or ocean springs at short distances offshore.

Occasionally these underground streams break out before reaching the sea and then they may be used in gravity irrigation. At Guines, some 30 miles south of Habana, is a stream of this kind, which for many years has been utilized in the irrigation of vegetable crops and sugarcane. The water supply of Habana comes from a number of underground springs and streams of this same character.

Climate and Vegetation

The climate of Cuba is tropical. The average temperature in Habana in January is 69.9° F.; in July, 80.4° F. The maximum is 95° and the minimum 50° F. Rainfall is not excessive at any location on the island, but it is abundant everywhere. The average annual precipitation is 47.57 inches. Cuba has two distinct seasons—the dry, beginning in November and ending in May, and the wet, beginning in May and ending in October.

More than 30 species of palms, including the famous Royal palm, grow on the island. Associated with palms and mahogany, pines are found in the Province of Pinar del Rio and on the Isle of Pines. Rich and nutritious grasses flourish throughout the island, affording excellent forage for stock. Pineapples, manioc, sweetpotato, and Indian corn are indigenous.

Agriculture

The agriculture of Cuba is not centered in large river basins as it is in many countries. Because of the narrowness of the island there is no long river draining a large agricultural area. Instead, the many short streams and the abundant rainfall make the production of tropical crops possible almost everywhere on the island.

Cuba has gained an important place in world sugar production, and economy of the island rests heavily on that commodity. Sugarcane is said to have been brought to Cuba by its first governor, Diego Velásquez, in the early part of the sixteenth century and introduced as a crop in the provinces of Habana and Matanzas. For more than a century its cultivation remained centered in those provinces, largely in areas near settlements along the coast. In recent years new areas have been opened up by railroads, and the virgin lands of the eastern provinces give greater yields than those long under cultivation in the western part. Now sugarcane is grown extensively throughout the island, except in the Province of Pinar del Rio, with Oriente leading in sugar production, and Camagüey holding second place.

Tobacco is the second-most-important commercial crop. The high-grade cigar-wrapper type grown in the well-drained land in the Vuelta Abajo district in Pinar del Rio Province is said to be the highest-priced tobacco in the world. Some good tobacco comes also from the red clay soils of the Partito district near Habana and from the Vuelta Arriba district in the Province of Santa Clara.

Fruits are grown throughout the island, pineapples, bananas, and grapefruits being exported in large quantities. A great pineapple area is located in Pinar del Rio Province. Bananas are exported from the coastal region east of Nipe Bay in eastern Cuba and from west of the Vuelta Abajo tobacco district. Oranges of excellent quality come from the red clay of Ceballos and from several other localities.

Vegetables grow luxuriantly in Cuba, especially in Habana Province. Peppers, eggplants, tomatoes, and lima beans are shipped to New York during midwinter. Corn, sweetpotatoes, cassava, and the tropical yam can be produced easily and abundantly nearly everywhere. One of the best producing centers of exportable vegetables is on the sandy lands of the Isle of Pines, located 33 miles south of Cuba.

Henequen, a plant yielding fiber which is used in place of manila hemp, is grown commercially on stony land. At present the area around the cities of Matanzas and Cárdenas is the chief henequen-producing section.

Cuba is a good cattle country, and hogs may easily be raised. The Royal palm alone produces clusters of fruits adequate for feeding great numbers of hogs.

Over-All Picture

Because of the lack of navigable rivers, Cuba must depend upon man-made means for transporting its products. A central highway now spans Cuba from Pinar del Rio to Santiago, a total distance of 705 miles. Altogether there are about 2,140 miles of paved and 225 miles of improved highways on the island.

Of main-line railways, Cuba has 4,880 miles. In addition, there are a few smaller lines and numerous private railways operated by sugar *centrales*, some of which act in part as public carriers.

Fifteen airports are available for public transportation, and numerous privately owned airports are used only for private planes, most of which are the property of sugar mills and other large industrial enterprises. Commercial seaplane accommodations are in use in Cienfuegos and Santiago.

Cuba is not and perhaps never will be a great manufacturing country. It does not have enough cheap fuel and lacks rivers of sufficient volume or fall to provide electrical energy. It is, however, perfectly suited to the production of all fruits and vegetables known to this latitude and, above all, to its two chief commercial crops, sugarcane and tobacco.

Mexican Village, by Josephina Niggli. 491 pp. Designs by Marion Fitz-Simons. University of North Carolina Press, 1945. Out of memories of a childhood spent in the northern Mexican village of Hidalgo, the author creates a novel filled with color and dramatic action and at the same time an authentic document on Mexican life. It is a folk tale, dealing with the romance, adventure, humor, tragedy, and even mystery in the life of the town. Each chapter is a complete story in itself centering around characters which reappear throughout the book. The device achieves a unit rich in warm and intimate detail.

Conocimientos Actuales Sobre las Enfermedades del Tabaco en el País, by Alberto C. Delle Coste. 23 pp. Ministerio de Agricultura de la Nación, Buenos Aires, Argentina, 1945. This bulletin is written to bring together under one cover all the available information on tobacco diseases in Argentina and to give an idea of the large field of action remaining for pathological research. Hitherto this material has been scattered in reviews, pamphlets, and files. The diseases given are classified under the general headings of fungous, bacterial, and virous, with an adequate summary of what is known of each in the country. A very complete bibliography is included.

Brazil, Bulwark of Inter-American Relations, by Henry A. Phillips. 228 pp. Hastings House, New York, 1945. In 59 comparatively brief chapters, grouped in four books under the titles "Chiaroscuro," "Geography of Raw Materials," "Brazil Novo," and "Potential Partners of the Peace," the author discusses Brazil—its resources, its characteristics, and the bases of cooperation in international relations. Under such chapter headings as "Forty Billion Cups of Coffee for Uncle Sam" and "Black River Through the Jungle" are given vivid accounts of the author's visits to Brazilian coffee fazendas and up the Amazon on a fishing excursion.

Prontuario de Parasitología Agrícola Animal y Vegetal, by Oliverio Téllez. 125 pp., illus. (colored plates). Bartolomé Trucco, Mexico, D. F., 1944 (second edition). This is a handbook on animal and plant parasitology. In it the author discusses parasites of bees, poultry, and other livestock; preservation of stored agricultural products; some definite pests and diseases and means of controlling them; household pests; and the health law of the United Mexican States.

Historia Económica de Cuba, by H. E. Friedlaender. 596 pages. Jesús Montero, Habana, Cuba, 1944. An extensive economic history of Cuba, starting with a description of the economy under Spanish rule and continuing by periods up to and including the modern. Under each period, such subjects as population, colonization, immigration, sugar, coffee, tobacco, commerce, economic evolution, and labor questions, including agricultural, are presented.

Who's Who in Latin America (Part II, Central America and Panama), edited by Ronald Hilton. 103 pp. Stanford University Press, Stanford University, California, and The A. N. Marquis Co., Chicago, Illinois, 1945. A collection of biographical sketches of leading Latin American figures was started as one volume by the late Professor Percy Alvin Martin. It is now being continued in seven parts, of which this is the second.

American-Spanish Syntax, by Charles E. Kany. 463 pp. University of Chicago Press, Chicago, Illinois, 1945. This compendium of linguistic peculiarities that differentiate Spanish-American usage from that of Spain gives variations in different countries and should be extremely useful to students of Spanish. Different parts of speech are taken up systematically. A special chapter on interjections and an extensive bibliography are helpful.

Los Estados Unidos, by Pedro Félix Vicuña. 389 pp. Editorial Saber Vivir, Buenos Aires, Argentina, 1944. This is a short history of the United States written for Latin Americans, dealing with outstanding figures and movements.

Editor's Note.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

AGRICULTURE IN THE AMERICAS O. R. CARRINGTON, EDITOR

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Gifts of the Americas

PARANÁ PINE (BRAZILIAN ARAUCARIA)

by ELIZABETH G. MAGUIRE

Brazil's valuable timber tree, one of the most important softwoods grown in South America, is known as the Paraná pine, although it is not a true pine and has no resin ducts. It is a species of *Araucaria* of ancient lineage, botanically termed *Araucaria angustifolia*, and more properly called Brazilian araucaria. This large subtropical conifer represents about 75 percent of all the lumber shipped from Brazil and is one of the main sources of wealth of the States of Paraná and Santa Catarina, the center of its commercial growth.

The tree grows in merchantable quantities over thousands of square miles in southern Brazil, centering in the plateaus of Paraná and Santa Catarina, and extending into the State of Rio Grande do Sul and adjacent portions of Argentina and Paraguay. Smaller stands are found in Mato Grosso, São Paulo, and Minas Gerais, and in the mountains farther north.

These beautiful araucarias form stately columns along country roads, and are seen towering skyward on distant hills, resembling huge parasols. They grow equally well on gently rolling hills, on level plains, or in the dense forests, wherever good soil, abundant rainfall, and suitable temperatures occur.

In the forest, the Paraná pine towers over well-defined lower stories of various species of hardwoods. Occasionally it reaches a height of 140 feet and a diameter of 10 feet, but generally ranges from 80 to 120 feet, with a diameter of 20 to 30 inches at breast height. The mature tree has a straight cylindrical bole clear of branches for about 50 feet, entirely covered with a bark varying from 2 to 4 inches in thickness. Near the top are whorled, almost horizontal but slightly down- then up-curving limbs forming a nearly flattened crown, with tufts of foliage at the ends of the branches. The tree gives somewhat the appearance of a giant candelabra. The leaves are from 1 to 2 inches long and about one-fourth inch wide, sea-green in color, attenuated and spiny-pointed.

There are four distinct stories in the forest. The upper story, or cap, is composed entirely of Paraná pine. Below at heights of 60 to 80 feet are various species of hardwoods, including the Lauraceae, known in southern Brazil as the canellas. One of these, the imbuya (*Phoebe porosa*), sometimes called the Brazilian walnut, comprises more than 50 percent of this story. Then comes a variety of growths reaching a height of 30 to 60 feet. Here are many members of the Lauraceae and Myrtaceae as well as mature stands of yerba mate (*Ilex paraguariensis*), source of the popular South American tea. The first story, or base, of the forest is comprised of tree ferns, bamboos, and underbrush mingled with immature trees of the stories above. Palms springing up intermittently through the lower growths give a tropical tone to the forest.

The wood of Paraná pine, or Brazilian araucaria, is moderately hard, heavy, and strong, and is largely free from defects, but low in resistance to decay. The sapwood is yellowish, the heartwood light brown, sometimes with bright red streaks. Most of the wood is used as lumber for building construction and shipping containers. It is particularly adapted for the inside finish of buildings. It is also made into plywood for paneling and wainscoting. Proper matching of the highly colored heartwood produces colorful and attractive designs. Its extensive use for shipping containers is due to its light weight and lack of odor. Still other uses are for certain types of furniture, such as kitchen tables, for paper pulp, broom and brush handles, barrel staves, scaffolding, and all sorts of small novelties. Brazilian match factories depend almost entirely on it for match sticks and boxes. In the United States it is used for slats in venetian blinds and as backing for electrotypes.

The Brazilian araucaria industry began to flourish in the first decade of the twentieth century. In 1910, only 3,300 short tons, equivalent to about 2,000,000 board feet, were shipped to outside markets as compared with about 352,700 tons in 1942, most of which went to Argentina and Uruguay. In 1940 Great Britain imported more than 50,700 short tons of the lumber. Shipments have been going also to the Union of South Africa regularly since 1935.

Although the demand for Paraná pine has been exceedingly great during the past three decades, there is no indication that the States of Paraná and Santa Catarina are in any immediate danger of losing their largest industry. A recent estimate places the total stand of trees of saw-timber size at from 200 to 300 billion board feet. If the industry is carefully handled, this should be enough to supply their markets for many years to come. Meanwhile it is to be hoped that methods for regenerating the Paraná pine forests by natural seeding or by planting will be developed, so that this important tree can produce a continuing crop of valuable wood.

CUBA'S RIVERS AND AGRICULTURE

by RUTH PARKER SCHOTTROFF

Columbus discovered Cuba on his first voyage to America, on October 28, 1492, and described it as "the most beautiful land human eyes have ever seen."

This largest and most western island of the West Indies, known as the Pearl of the Antilles, is shaped like an arc, with its convex side to the north. It lies just south of the Tropic of Cancer, approximately 100 miles from Florida and 130 miles from the Yucatán Peninsula of Mexico. The island is about 730 miles long, varies in width from 25 to 124 miles, and has a coast line of over 2,000 miles with many excellent harbors.

The north coast of Cuba is steep and rocky, bordered by coral reefs and by small islands mostly low and covered with mangrove forests. On the southeast between Cape Cruz and Santiago de Cuba, the Sierra Maestra rises abruptly from the sea to several thousand feet. The southwestern coast from the Gulf of Guacanayabo to Cape San Antonio is low and marshy, with the exception of a short stretch between Trinidad and Cienfuegos.

About three-fifths of the island is flat or gently rolling, admirably suited to agriculture. At the two extremes, in Pinar del Rio on the west and Oriente on the east, are well-defined hills. In the southern part of the Province of Las Villas are rounded hills and beautiful valleys.

The Rivers

Nearly 200 streams enter the sea, flowing mostly in a north or south direction, but they are short and few of them are of any importance for navigation. The largest is Río Cauto, which has its origin in the Province of Oriente, on the north slopes of Sierra Maestra. It flows westward 150 miles through a broad valley and empties into the Gulf of Guacanayabo. This stream is navigable for light-draft boats as far as Cauto del Embarcadero, a distance of 50 miles. The Río Sagua la Grande is also navigable for 20 miles or so. Several other streams are navigable for a few miles but, in most cases, only through what may be regarded as estuaries.

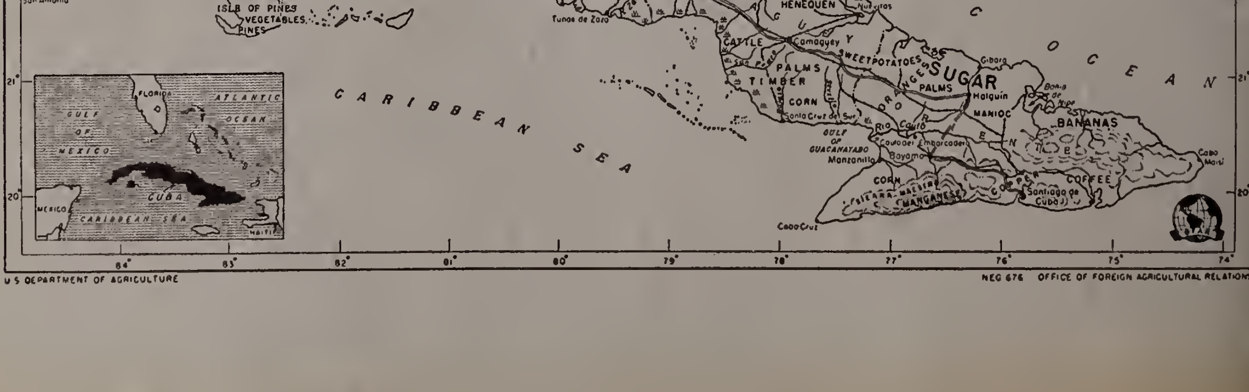
Many of the short streams have obstructions in their channels and spread out over expansive flats, never reaching the sea. They inundate large tracts of coastal plain for long periods during the rainy season. Drainage of these low wet lands is one of the major problems involved in order to increase the agricultural area.

The chief contributing factor to the small volume of water in the rivers is the nature of the soil through which they flow. The predominant soil in Cuba is a red clay, derived from or overlying a limestone foundation. In places this red clay exceeds 25 feet in depth and is so porous that it takes up nearly the entire rainfall, which in some parts of Cuba exceeds 70 inches annually.

In the red lands dominating the plains of Camagüey and of Ciego de Avila streams occur infrequently and when they do exist are generally without water in the dry season, except those which have their sources in the higher watersheds. One area of 500 square miles in southeastern Matanzas Province has no streams throughout its entire extent. This broad flat area lies largely below the 50-foot contour line and has a slope toward the sea so gentle that the eye cannot detect it.

From the Bay of Cárdenas southward through Jagüey Grande to the head of the Bay of Cochinos on the opposite side of the island, a distance of 54 miles, not a single contour line is shown on the military map of Cuba, nor are there any streams. The bulk of the rain water sinks directly into the soil. Some does flow off as sheet water

(Continued on page 77)



Agriculture in the Americas

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May 1946

EASTERN DRAINAGE AREA OF BRAZIL

(*Continued from back cover*)

The Paraíba rises near the city of São Paulo and flows across the State of Rio de Janeiro to the Atlantic. It follows a broad fertile valley in which rice, coffee, oranges, and sugar are produced. Its length of over 500 miles is navigable for 150 miles.

Climate and Vegetation

The eastern drainage area has three principal types of climate: tropical rainy, tropical highland, and tropical savanna. The tropical rainy climate is found along the narrow coastal plain and the seaward slope of the escarpment. Average annual rainfall, borne in by the southeast trade winds which blow steadily against the coast, ranges from 60 to 130 inches, the heaviest falling on the slopes. Maximum rainfall occurs in the summer months—December, January, and February—but this region is never dry. The heavy rainfall supports dense tropical rain forests which yield lumber and charcoal, and, along the coast and major streams, plantation production of cacao and sugar.

The tropical savanna and highland climates occur inland on the plateau, where the abrupt rise of the escarpment from the coastal area forces the inflowing trade winds upward, reducing the rainfall.

Most of the savanna area, which is the northern part of the plateau, has a yearly rainfall exceeding 40 inches, but annual dry seasons of several months prevent the growth of forests. In their place grasses, shrubs, and stunted trees grow. The natural forage permits the grazing of cattle, the primary enterprise of the Brazilian savannas.

In the tropical highland region, the southern portion of the plateau, annual rainfall ranges from 50 to 60 inches, with comparatively little rain during the winter—June, July, and August. June is generally so dry that vegetation becomes parched, but the dry period is shorter and less intense than in the savanna region to the north. The mean annual temperature of the moderate-elevation highland is 65° F.

Resources of Drainage Area

The major resources of this drainage area are agricultural commodities and minerals. Sugar production in Brazil is sufficient to supply domestic requirements, and it is estimated that about 50,000 short tons will be exported in 1946. In the early days the great sugar plantations had land-owning aristocracy, slaves, tenants, and small-scale mills. Today they are largely replaced by extensive commercial enterprises employing wage workers and transporting cane from a wide area to centralized mills. In the eastern drainage area sugarcane is grown chiefly along the coast north from Salvador.

Cotton, tobacco, and rice likewise are grown northward from Salvador. Cotton is produced farther inland than sugarcane and rice, as it requires less rainfall.

Rice production is important in the Middle Paraíba Valley, where it is grown on broad flood plains 5 to 10 miles across. The Valley produces this cereal chiefly for consumers in the cities of São Paulo and Rio de Janeiro, but rice is widely grown throughout the entire littoral as a subsistence crop for local use and for export.

Orange groves were planted extensively in the late 1930's and early 1940's on hillsides near the city of Rio de Janeiro and in the Paraíba Valley. Plantings expanded rapidly, mostly for fruit export, but production declined from about 40 million boxes annually during 1935–39 to an estimated figure only half as great in 1945.

Once Brazilian coffee production was centered in the Paraíba Valley in the State of Rio de Janeiro. Since 1860 coffee fazendas of this valley have been slowly disappearing. Competition with better-favored coffee areas in São Paulo State caused much of the Paraíba Valley land to return to pasture.

Cacao plantings have expanded in a zone 50 to 100 miles wide paralleling the coast of northern Espírito Santo and southern Baía. Warm rainy climate and suitable soils have caused this region to become second in production to the African Gold Coast, the world's leading cacao producer. The cacao zone reaches the sea at Ilhéus, but elsewhere it begins 20 to 30 miles inland and extends to the rising slopes of the escarpment. The plantings follow narrow river valleys inland when the face of the escarpment is reached.

Cattle provide a steady moderate source of income in the States of Rio de Janeiro, Minas Gerais, Espírito Santo, and Baía. Dairying is practiced within a radius of 100 miles of the city of Rio and in the environs of others. Beef cattle are grazed throughout a large area.

Minas Gerais is Brazil's most important corn-producing State. In 1945, this State produced about 64 million bushels of the nation's estimated 200 million bushels. For many years these figures have varied little. In 1945, the States of Rio de Janeiro, Baía, and Espírito Santo produced 10 million, 3 million, and 2.8 million bushels of corn, respectively.

In the western part of the eastern drainage area are important mineral deposits. The early Portuguese settlers extracted and exhausted fabulous fortunes of gold in the century following the discovery of the mineral in 1692. In the late 1720's, diamonds were discovered in the Diamantina area. Several Minas Gerais diamonds are world famous, the most important of which is a 727-carat blue-white stone found in 1938.

Important deposits of manganese, bauxite, and iron ore are located in this State. The largest deposit of iron ore in the Western Hemisphere is located here, containing an estimated 5 billion tons, the higher-grade ores yielding 50 to 69 percent iron. The ore is moved by rail to Vitória, thence by sea to foreign users. Brazil has little coal of the type required for smelting. U. S. and British wartime loans have helped develop the deposits. During the war, the ore went to Britain by agreement and probably will move there in the future, as Great Britain exports coal to South America and ore can be carried back in the empty vessels.

Agriculture IN THE *Americas*

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Let's Cooperate

Determination of effective means of cooperation among the Americas to develop agriculture and home economics was the purpose of the author's recent visit to several South and Central American Republics.

by AUBREY D. GATES

The spread of scientific agricultural information and a knowledge of the systems for discovering and using that information throughout the world will help all of the world. The great common enemy of all mankind, hunger, can be successfully combatted only in this way. As hunger disappears from the earth, the basis for a better relationship among nations and for a lasting peace can be laid.

Especially important is cooperation in the development of agriculture and home economics among the Americas. During a recent visit in Ecuador, Guatemala, Nicaragua, Colombia, El Salvador, and Mexico the writer was impressed by the interest which students were manifesting in the science of agriculture in the places where scientific agricultural research and experimentation were under way and by the challenging opportunity for enlarging the means by which the results of such experimentation may be made available to all the people of the American Republics.

"How is it," I was asked in many places, "that the farmers of the United States were able to produce so much more food in wartime than they did before the war?"

The answer to that question begins in the belief that the farmer as a class is one of the most patriotic of all the groups of citizens. Especially when the nation is imperiled by war is he willing to work longer hours and more days per week and month.

Much of Ecuador's fertile farm land is watered by the melting snows of the high Andes.

Many girls are receiving training in Ecuador as home demonstration workers for that country's expanded Extension Program.

Back of the individual farmer's patriotism and willingness to work hard there are 150 years of public education, 85 years of existence of the land-grant colleges and of the U. S. Department of Agriculture, and 75 years of research at experiment stations located in every State in the Union. There is the knowledge gained through 30 years of existence of the Cooperative Extension Service, 25 years of teaching by vocational agricultural teachers, and many years of development of machines and labor-saving devices for farmers' use. More than this, the many farm magazines, journals, and urban and rural newspapers have carried scientific agricultural information to United States farmers daily and weekly.

The three divisions of the system in the United States are closely interdependent and all of equal importance. First, the College of Agriculture with its teaching staff, where students are trained both as research workers and as extension agents and teachers, is the hub of the system in each State. Second, as a part of the College of Agriculture, the experiment station, with its branch or substations scattered over the State in the various soils and climatic areas, supplies the scientific data gathered through the efforts of research scientists. Third, the Extension Service is the other arm of the College of Agriculture, with its staffs of specialists and county extension workers located in every county of most States striving to spread rapidly the information of better methods in agriculture, better varieties of crops, better breeds of livestock, better feeding practices, and better standards of living and nutrition for the farmer and his family.

Coordinate with these three phases is the U. S. Department of Agriculture with its financing and research. All have had their proper functions, and without any one the agricultural picture would not be nearly as bright as it is today.

Application to Other Countries

With all there is to recommend this system, we do not suggest that it be picked up as a whole and set down in any South or Central American Republic. We would urge that it be studied carefully and such parts of it as will fit into the local pattern of any Republic be adopted. Latin American cultures are much older than ours. Customs and patterns of living are deeply rooted in many generations that antedate cultural patterns in the United States. The job of reaching *all* the people is a complex and slow one, calling for long-range planning and patience.

It is my opinion that in the long run the people best qualified to deal with these cultural institutions are Latin Americans. Aid can be given by the United States, but programs and the application and adaptations must be made locally. In those countries where a few general principles of mutual assistance have been agreed upon, much progress has been and is being made.

It was encouraging to find the programs of the Division of Cultural Cooperation of the U. S. Department of State, in the field of general education, and the programs of the Office of Foreign Agricultural Relations of the U. S. Department of Agriculture, in agricultural experimentation and extension, welcomed and adopted by various countries. It was cheering to see the way in which the carefully chosen staffs of these two Departments were developing the programs in each country with the officials of the Republic and with full regard to and respect for the particular local culture and conditions. The attitude of both Latin American and United States officials was wholesome and cooperative.

This situation encourages us to believe that there is a bright future for programs of mutual assistance. This is especially true in the complementary-crops program and in trade relationships based upon these programs.

Cooperation of Scientists

In working out programs for even greater mutual assistance, certain considerations seem to be essential.

Dr. Gates is Associate Director of the Extension Service, University of Arkansas. At the request of the Department of State he recently visited Ecuador, Colombia, Nicaragua, El Salvador, Guatemala, and Mexico to study the agricultural program between this country and Latin America, with emphasis on the trainee work. Pictures for the article were taken by Dr. Fred P. Frutchey, U. S. D. A. Extension Service, who accompanied Dr. Gates on his trip.

The first part of the program is the assignment of capable scientists to expand and strengthen the various programs of experimentation. Machinery should be set up whereby any Republic which desires to secure the services of these scientists could let its desires be known, through the State Department, to the Office of Foreign Agricultural Relations. This Office could, in turn, go to the particular university where the best-fitted man in that field is employed and work out a satisfactory agreement with him and with the institution so that he could go on the assignment with the assurance of eventually returning to his position without loss of rank or pay. Most institutions would profit from having one or two men on detached duty who would return to their positions bringing a broadened experience and viewpoint. The recommendation is strongly made that regardless of how well qualified a scientist may be in his field of work he should be required, before going, to master the language of the country in which he will work.

The minimum size of staff required to do most effective work depends upon the Republic, its desires and the conditions that prevail. In some countries I found a desire for cooperation to the extent of a fairly complete staff. In others only one or two men were needed to augment the staff of the college and experiment stations now in operation. A balanced program is the goal. In general, the need is for technicians to deal with the basic sciences in food, fiber, and livestock production, insect and parasite control, and plant breeding for complementary crops. In addition, a leader to work in the development of an extension system will be needed. The aim is always to train local residents to assume responsibilities of the work in their own countries.

South American students listen to addresses by 4-H Club leaders in the auditorium of the U. S. Department of Agriculture.

Many agricultural students receive training at the beautiful *Facultad Nacional de Agronomía,* Medellín, Colombia.

Student Training Program

A second job of major importance is to expand the present programs to bring many of the best-qualified young students from the Other Americas to the United States for training in scientific fields. An arrangement with one of the leading Southern universities, where climate, crop, and soil conditions would be somewhat similar, to maintain a special department to do this training, rather than placing these men in various institutions, would be of great advantage. Tropical agriculture and customs of the people are in many ways different from conditions in this country, and one or two South or Central American students taking courses in large classes of North American students often find it difficult to get the specific training needed and to make application to their own conditions. Also, the need is for training in research techniques rather than for specific research information on crops grown in the United States. One specialized department with a selected staff in a single institution could give this training, whereas it is difficult for many different universities to give such specific instruction.

The many fine young men who are coming to the United States for study will do much to institute and develop the needed programs when they return home and to cement good relations among the Americas. We should look forward to an even more closely coordinated training schedule in this country with the view to development of a closely correlated program in the student's own country. Inasmuch as facilities and finances may be limited in some countries, a student being trained in soil conservation, agricultural economics, forestry, or extension work should be shown how his particular work relates to other phases and how all of these are a part of a whole pattern and must be fitted together into a program of assistance to farm people.

Problem of Textbooks

In visits to various agricultural schools and with agricultural officials in Latin America I heard something of the problem of getting textbooks and reference books in agricultural subjects. Collaboration between the U. S. Department of Agriculture and the land-grant universities might help solve this problem. Although the applications in a particular field would be different, there are certain general principles that apply everywhere. In dairying, for example, the principles of breeding, feeding, and care of milk will be much the same the world over. If then, the animal-industry staff at the land-grant college in one of the leading dairy States would compile and arrange the publications and information they have in dairying into a text or reference book, to be translated into Spanish for distribution in countries where such a book is desired, they would render a service of immeasurable value. Perhaps another State could do the same for poultry, another for swine, and so on until an adequate library would be built up. All of this should be worked out in cooperation with scientists of the U. S. D. A., and translations would need to be made either by a special staff in the Office of Foreign Agricultural Relations or in the Department of State, where many scientists are fully familiar with Latin American conditions and needs.

Home Economics Important

Home economics has played an important role in the development of farm life in the United States. In agricultural extension work it is especially important as it relates to agricultural production and consumption. In many States the policy is to make the services of county agents available to farm people only when provisions are made for home economics extension.

The farm family is a unit working together to produce on the farm and to provide an adequate home. In raising levels of living in the home, the farmer has been helped to prosper economically and to live in comfort. To live in comfort means that the family becomes a better consumer and thus promotes the general prosperity of the country. The American home is the cradle of the American way of life. Training in home economics enables the homemaker to handle better the problems she meets each day and to build for the future. In matters of health, nutrition, clothing, housing, schools, and family life she is as well equipped educationally as her husband is to produce crops and livestock.

Because of its importance in the life of any people, home economics deserves a place along with the research and teaching of agriculture. In reality it is a part of agriculture, and it calls for the same cooperation in training as in other fields.

Program One of Mutual Sharing

In these recommendations there is no suggestion that all the advantages would be on one side. It is assumed that each country would bear a just share of the financial costs of the programs dependent upon individual or group-negotiated agreements just as is being done in many cases at the present time. What is proposed here should prove mutually helpful to both the United States and Latin America.

NAMES & NEWS

C. Warren Thornthwaite, Soil Conservation Service, USDA, has returned from Mexico, where he assisted officials of that government with the joint program of research in agricultural climatology which has been developed over the past 3 years between the Departments of Agriculture of the United States and Mexico. Dr. Thornthwaite made two previous visits to Mexico to assist in the preparation of a new weather map, to install an agricultural meteorological observatory at the Chapingo National Agricultural School, and to make a study of the irrigation needs of Mexico.

Miss Gertrude L. Warren, In Charge of Organization of 4–H Club Work, Extension Service, USDA, has just returned from a visit to Cuba and Jamaica, where she attended the 5–C Club Exposition at Holguin and conferred with government officials in Havana and Kingston with regard to the over-all program in these countries. Her visit to Cuba was made at the special request of Dr. German Alvarez Fuentes, Minister of Agriculture, and to Jamaica at the invitation of J. C. Hotchkiss, Director of 4–H Clubs for Jamaica and other British possessions of the Caribbean. Miss Warren was accompanied by *Miss Dorothy Emerson*, State Girls' 4–H Club Leader of Maryland.

DOMINICAN COFFEE

To many people one or more cups of coffee have become so necessary a pleasure in each day's routine that the story of where that coffee comes from and how it is produced is an interesting one. This is the story of "Café de Santo Domingo."

by ROLLO P. STOVALL

The coffee plant was first introduced into the eastern part of Hispaniola, now known as the Dominican Republic, during the early part of the eighteenth century. Later, better plants were imported from the French island of Martinique. These Martinique plants had developed from a single valuable coffee plant which is said to have been brought from Paris by a young French naval officer after a long and difficult voyage.

During recent years coffee has been one of the most important products exported from the Dominican Republic. Not only is coffee an important cash crop for many small producers, but it is considered a necessity for Dominicans themselves. The Dominicans drink a demitasse before breakfast and thereafter several times a day, usually with 2 or 3 teaspoonfuls of Dominican sugar. It is necessary to be seated always when drinking coffee, for in the Dominican Republic it is considered bad luck to take coffee standing up. A small cup of coffee is always taken after each meal and a larger cup of coffee and milk for breakfast. The best coffee is exported, but a great deal is left for home consumption.

It Grows in the Highlands

To produce good coffee, experienced growers say, a climate averaging at least 60° F. is required, without danger of frost and with around 60 inches of rainfall. An elevation of from 1,000 to 5,000 feet is considered best for growing a mild-quality coffee. About two-thirds of the Dominican Republic is mountainous, and the temperature ranges from 54° to 77° F. There are, therefore, large areas on the island suitable for the production of coffee, where rainfall is sufficient and the soil is suitable, but where labor is not available and transportation is not adequate.

The main coffee-producing areas of the Dominican Republic are the highlands of the Cordillera Central in the central part, the Cordillera Septentrional and the Cibao Valley in the north, and the Bahoruco and Ocoa Mountains in the south. Each of the producing areas has its own particular quality of coffee because of the conditions under which the trees grow. Most of the coffee is produced in the mountainous regions at an altitude of 2,000 to 5,000 feet, but in the Cibao Valley there are a few mixed coffee and cacao plantations at almost sea level. The coffee trees are gradually being removed from the mixed plantations, however, because the quality of lowland coffee is not as good as that of the highland. Furthermore, the coffee trees do not permit the cacao to have the best conditions for maximum production.

How the Dominicans Cultivate Their Coffee

In the Dominican Republic the only variety of coffee cultivated is the *Coffea arabica*, considered the best type. *Cafeteros*, or growers, follow the practice of providing shade for their coffee trees. The bean is planted in a seedbed and transplanted to a nursery at the age of 2 months, being carefully shaded with palm leaves during this early period. When the young tree is about 2 years old it is transplanted in the *cafetal*, or plantation. Here the young trees are

Courtesy of the Commission for the Defense of Coffee and Cacao

Coffee trees in bloom in the Dominican Republic. The trees usually flower 3 times each year and may flower a fourth time if the weather is abnormal.

Courtesy of the Commission
for the Defense of Coffee and Cacao

Coffee cherries are dried in the sun at Bani.

set out about 10 feet apart, and the plantain or banana tree is used as a temporary shade. This early shade is replaced as soon as possible by the guamá tree (*Inga vera* Willd), which is the permanent shade for the coffee tree. The guamá tree requires several years to reach sufficient size to give adequate shade. Meanwhile the grower has some return on his investment from the fruit produced by the temporary-shade plants before the coffee trees are productive. As soon as the guamá is able to protect the young coffee trees, the plantains and bananas are cut down.

Coffee trees usually are kept at a height of 9 to 12 feet. They start producing berries, or cherries, when about 4 or 5 years of age but not until 8 or 9 years do they reach their best production. Some producing trees are 100 years of age; the majority of trees in the Dominican Republic, however, are between 25 and 40 years of age. Although the total area covered with coffee trees is less than 131,000 acres, there are more than 36,000 farms. Many of these *cafetales* have less than 5 acres of coffee trees. Each acre may support from 390 to 520 trees. A single tree may produce 3 pounds of marketable coffee beans annually, but the average yield is usually a smaller quantity.

As a rule, the plantations are cleared and cleaned just prior to picking time. They are cleaned again after the harvest or before the first flowering period of the next crop. The weeds and undergrowth, if not cleaned out, would make gathering the cherries practically impossible and would choke the growth of the tree. Fertilizers are used only on a small scale.

The trees usually flower three times each year and may flower a fourth time if the weather is abnormal. The first flowering takes place in January and early February. The second and heavier one comes in March, and a third in April.

Harvesting

The coffee cherries are ready for harvest in low places around the first of October and are gathered until the end of December. In the higher areas the harvest begins in November and lasts until early March. Both men and women, sometimes even children, pick the ripe red cherries. Families often move from the lowlands to take temporary quarters in the mountains, carrying their possessions with them, including two or three young goats or suckling pigs.

The picker takes off the cherries, one by one, and puts them into a basket or a container known as the *macuto*. The harvested cherries are then processed as *corriente* (natural) or *lavado* (washed) according to the equipment which the individual *cafetero* has.

If the coffee is processed as *corriente*, the cherries are dried in the sun for a period of from 21 to 28 days and then sold to a coffee factory, where they are hulled and sorted by machinery and then cleaned by hand. Most of the coffee which goes into foreign trade is *lavado*, or washed. In processing this type the *cafeteros* either remove the outer skin of the cherries with their own *despulpadoras*, or dehullers, or sell the freshly gathered cherries to a central factory where they are dehulled and processed. After the outside skin or pulp is removed, the resulting beans, two from each cherry, are fermented from 12 to 24 hours to liquefy the mucilage. The coffee bean is either sun-dried for 5 days or dried by a mechanical device in about 36 hours. The coffee bean is then hulled to remove the *pergamino*, or second skin, and the light-silver colored third skin which is around each of the beans. These beans have a light-green color.

Before the coffee is ready for marketing, it is hand picked to remove the imperfect beans and is classified as: Washed, Nos. 1, 2, and 3; Natural, Nos. 1, 2, and 3; and *passilla* or *trilla*. The last named are the poorer beans taken from the other qualities in cleaning and classifying.

Marketing and Government Regulations

The coffee which is exported is placed in sisal or jute bags marked "Café de Santo Domingo," with the classification and name of the region where it was produced. Each bag contains 60 kilos, about 132 pounds. An effort has been made to provide domestic bags by the establishment of a factory which uses imported and locally grown sisal to manufacture bags.

Mr. Stovall is Economic Analyst at the American Embassy, Ciudad Trujillo, Dominican Republic.

As is true in many of the other Latin American coffee-producing countries, the Dominican Government has taken control of coffee production and marketing. The country is a member of both the Inter-American Coffee Board and the Pan American Coffee Bureau. The former deals with problems arising between the producing countries and the United States, and the latter endeavors to promote the best interests of the producers.

The Commission for the Defense of Coffee and Cacao issues export permits and furnishes assistance to both growers and exporters. It is conducting an active campaign to improve the quality of the coffee bean and to increase production. A coffee census taken in 1943 provides information concerning the condition of the *cafetales* and the industry as a whole. To cut down a coffee tree is prohibited unless permission has been obtained from the Department of Agriculture, Livestock, and Colonization.

The Commission enforces the laws and regulations controlling the grading of beans. It has a coffee-cup tester who was trained by a large coffee concern in New York City to taste coffee scientifically. He is an agronomist and specialist in coffee culture and directs the technical work of the Coffee Commission. He tastes the various samples of coffee by sipping the freshly brewed liquid, and his reports are used in classifying the beans for export. He also tells the grower what is wrong with his coffee and gives advice as to what should be done to correct the imperfections and improve the quality. For example, if the coffee has a musty taste, he will probably inform the *cafetero* that the coffee beans were improperly dried.

The export trade of coffee is mainly in the hands of a dozen export-import houses which specialize in the exportation of coffee, cacao, and other agricultural products. Prior to the war France was the principal

(*Continued on page 90*)

Courtesy of the Commission for the Defense of Coffee and Cacao

Coffee in customs warehouse in Ciudad Trujillo.

Reading about the AMERICAS

The Reconstruction of World Agriculture, by Karl Brandt. 416 pp., tables and charts. W. W. Norton & Co., Inc., New York, N. Y., 1945. Dr. Brandt, Economist in Stanford University's Food Research Institute, and formerly director of the German Institute of Agricultural Market Research, wrote this book to "contribute to public discussion some pertinent factual background as well as argumentative interpretations of various national and international policies, which may further the restoration of agriculture to its normal role in an era of peace."

It contains chapters on such topics as the following: The effects of World War I upon world agriculture; World agricultural trends in the twenties and thirties; The impact of World War II upon the world's food economy, agriculture, and the rural community; Food requirements and agricultural adjustments necessary during the demobilization period; Basic controversial issues in a world agricultural policy for an era of peace; Reconstruction of world agriculture. Under the last-named topic, sections are devoted to Canada, Argentina and Brazil, and the United States.

Brazil—People and Institutions, by T. Lynn Smith. 843 pp., illus. Louisiana State University Press, Baton Rouge, La., 1946. Dr. Smith approaches the great Portuguese-American country in South America from the point of view of a sociologist. He strives to analyze Brazilian society, emphasizing its diversity and its overwhelmingly rural nature. The first 630 pages are devoted to the people—cultural diversity, distribution and growth of population, statistics of mortality and immigration, levels and standards of living, and relations of the people to the land. The remaining part concerns social institutions—marriage and the family, education and schools, religious and government institutions. A glossary of Portuguese terms, an extensive bibliography, and author and subject index are included.

Editor's Note.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

ALONG THE *Agricultural Front*

▲ Babassú-Cracking Machine Tested in Brazil

Scientists and growers are observing with interest a series of experiments that are being carried on in the State of Maranhão, Brazil, with a new machine for cracking babassú nuts. The machine is reported to have given satisfaction in a trial involving the cracking of 3,000 pounds of nuts, which yielded 221 pounds of kernels, 113 pounds of husks, and 120 pounds of meal.

▲ Home Demonstration Week Observed May 5 to 12

The Extension Service of the U. S. Department of Agriculture and of each of the 51 land-grant colleges located in the 48 States, Hawaii, and Puerto Rico will cooperate with farm women in observing National Home Demonstration Week from May 5 to 12. The theme for the week will be "Today's Home Builds Tomorrow's World." During the week, the 3 million women enrolled in home demonstration work will show through meetings, exhibits, tours, and radio programs the progress that has been made in rural, family, and community living since the home demonstration program was started over 30 years ago.

Home demonstration work has stimulated a wide range of interests for rural families in community and world affairs. In 1944 a quarter of a million rural women studied home care of the sick; almost 800,000,000 quarts of home-canned food were placed on pantry shelves; sewing-machine clinics and tailoring workshops were held from Oregon to Massachusetts; and from Maine to Hawaii groups of rural women assisted in sponsoring hot lunches and children's clinics.

Typical achievements of groups or individuals which will go on display during National Home Demonstration Week will include home-grown food supplies, remodeled homes, wardrobe supplies, refinished furniture, time- and labor-saving equipment, handicrafts, landscaped yards, community centers, community libraries, and sickroom loan kits.

▲ Historical Association Announces Fellowship

To aid competent scholars in the Western Hemisphere, the American Historical Association has announced the Albert J. Beveridge Memorial Fellowship of $1,000 which will be awarded annually for the best original manuscript, either completed or in progress, on American history. By "American history" is meant the history of the United States, Latin America, and Canada, from the sixteenth century to the present.

Manuscripts may range from 50,000 to 125,000 words in length and must be of a scholarly character. Literary merit will be an important factor in determining the award. Biographies, monographs, and works of synthesis and interpretation are eligible; translations, anthologies, and collections of documents are not. The winning manuscript will be published by the Association, and the author will receive a 5-percent royalty on the retail price of the book after editorial and manufacturing costs have been met. To be considered for the 1946 award manuscripts must be submitted not later than September 1, 1946.

For applications and further details, write Arthur P. Whitaker, 208 College Hall, University of Pennsylvania, Philadelphia 4, Pa.

DOMINICAN COFFEE

(*Continued from page 89*)

market for Dominican coffee, with the United States the second-best customer. Between them, these two countries purchased more than half of the coffee exports. During the war the United States bought most of the Dominican coffee sold in the world market under the quota arrangement set up by the Inter-American Coffee Board. From 18 to 32 million pounds of green coffee beans are exported each year, and in 1945 the amount was nearly 40 million. The fact that a good crop is usually followed by a lean year perhaps accounts more for the variations in the annual quantity exported than does the foreign demand.

While there is no record of actual consumption, the Dominicans probably consume almost as much coffee as is exported. In mid-morning and mid-afternoon the *cafeterías*, or coffee shops, of the capital, Ciudad Trujillo, are filled with customers for their cups of coffee.

AGRICULTURE IN THE AMERICAS O. R. CARRINGTON, EDITOR

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Gifts of the Americas

QUININE

by F. RAYMOND FOSBERG

An important part of the history of medicine has been a search for specifics, substances that effect cures for particular diseases. The popular idea of any medicine has always been that it is a specific. Yet, until the discovery of the sulfa compounds, true specifics have been extremely rare. One of the earliest to be discovered and proved beyond doubt as a specific for malaria was quinine, found in the bark of the cinchona tree.

As a scourge of humanity and wrecker of civilizations probably no disease can equal malaria. Wherever anopheline mosquitoes exist in company with human beings in warm climates, the protozoan parasites, genus *Plasmodium*, responsible for the several forms of recurrent fevers called malaria, have followed.

The earliest history of the discovery and use of quinine is hidden in confusion and legend. The Indians of the Loja region probably used cinchona bark as a remedy for something. Its first application to malaria may well have been accidental. The first recorded use in curing a European was at Malacatos, Ecuador, in 1630. Before long it became a valuable American export.

One of the most important aspects of the story of quinine is the stimulus it provided to the science of organic chemistry. A commerce in so valuable a product naturally led to the development of improved analytical methods. Continuous efforts were made to synthesize quinine. Until 1945 they did not even lead to laboratory synthesis, but aniline dyes and other things were discovered incidentally, and the foundations of modern organic chemistry were laid.

Other alkaloids were found to exist in cinchona bark, some of them with antimalarial properties similar to those of quinine. One, quinidine, was found to be a remedy for heart ailments. Upon quinidine several thousands of elderly people depend for their very lives.

Trees of the genus *Cinchona* grow naturally only in tropical America, although they have been carried by man to all parts of the Tropics. The quinine-producing species of *Cinchona* are found in the temperate and subtropical altitudes of the Andes from Bolivia north to Venezuela and Costa Rica in wet montane forests.

Early in the history of the industry attention was called to the ruthless exploitation methods being used. Obviously the supply would be rapidly exhausted if such wanton destruction continued without regard for reproduction of the trees. As the bark became scarcer and scarcer and the price higher and higher, new and more remote regions were penetrated.

European powers, dependent upon a foreign supply of quinine, and becoming alarmed at the threatening scarcity, promoted investigation of the possibilities of producing plantation quinine in the Tropics. Many expeditions were sent out to secure seeds and plants. Various introductions were made into India, the East Indies, and other tropical regions, but without conspicuous success. Finally, with the establishment of the Ledger strain of plants from Bolivia, Dutch effort and scientific research began to pay dividends. Within a few years plantation quinine from Java had practically replaced the American wild product.

Fortunately the cinchona tree is not easily killed. As long as the forest in which it grows is not completely destroyed, sprouts come up from the stumps of trees that have been harvested. The long period of inactivity that followed the success of the plantations allowed extensive regeneration to take place in the forests.

When Japan overran the East Indies plantations, the American industry revived. Sprouts of trees harvested in the last century now provided the basis of such a boom as the industry in America had never seen. Within a space of 2½ years about 18,000 tons of cinchona bark were harvested in Colombia, Ecuador, Peru, and Bolivia, and quantities of quinine and totaquina, a somewhat refined extract from the bark, containing quinine and other antimalarial alkaloids, were produced to relieve the shortage and to make possible the reconquest of malaria-ridden areas of the Mediterranean and the Southwest Pacific.

Meanwhile, chemists were working as industriously as the bark gatherers. Atabrine was more nearly perfected as a substitute, until in the practice of many doctors it had almost supplanted quinine. Since then, new antimalarials have been developed. Quinine is no longer unique in its field, but has strong competition. It will doubtless continue to be used for a long time, but unless other applications for it are developed quinine will probably not again enjoy the preeminence it had during the past three centuries.

THE EASTERN DRAINAGE AREA OF BRAZIL

by OSCAR MOORE

The section of Brazil extending along the Atlantic Ocean from just above Santos northward to a point 200 miles beyond Salvador forms a region of geographic entity, the Brazilian eastern drainage area. Some 25 rivers traverse this thousand-mile-long coastal area, flowing easterly to the Atlantic from the face of a high escarpment—the seaward edge of the Brazilian Plateau, which ranges in altitude from 2,500 to 8,000 feet. The interior side of the plateau is drained by tributaries of the Amazon and Paraná.

Approximately 75 percent of Brazil's population of about 42,000,000 is located along the coast, a large proportion being in the eastern drainage area. The region includes the following States: The coastal portion of northern São Paulo, the important coffee-producing State; Rio de Janeiro, where the Federal District and the national capital are located; Minas Gerais, the mineral-producing interior State; Espírito Santo and Baía, coastal States where plantations produce cacao, sugar, cotton, and tobacco chiefly.

Rio de Janeiro, with a population of over 1,500,000, is the chief city and the capital of Brazil. It is the second-largest city on the South American Continent, exceeded only by Buenos Aires. On January 1, 1502, an expedition from Lisbon, while searching for fresh water, found what they called a river leading between mountain peaks into a large landlocked body of water, now known as Guanabara Bay. They are said to have named the small so-called river Primeiro de Janeiro, after the date of discovery, and the name was later shortened to Rio de Janeiro. Beside this beautiful entrance to the harbor grew up the city named from the river of Janeiro. About 750 miles up the coast from Rio is Salvador, the capital of the State of Baía. It lies at the entrance of Brazil's second great landlocked harbor, known as Baía de Todos os Santos. These harbors can accommodate large ships, and through them a substantial part of Brazilian commerce is handled.

The Jequitinhonha River originates in Minas Gerais, crosses southern Baía, and reaches the sea in a swampy area between Belmonte and Cannavieiras. It has a length of some 500 miles, 84 of which are navigable.

The Doce rises in Minas Gerais likewise but flows to the sea through Espírito Santo. It cuts deeply through the escarpment, making possible the construction of a railway along its course from the iron deposits of Minas Gerais to the port of Vitória. The Doce's lower reaches are navigable for 138 miles.

(*Continued on inside front cover*)

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June-July 1946

NAMES & NEWS

Allee Becomes Director Inter-American Institute Of Agricultural Sciences

Ralph H. Allee, Assistant Chief, Technical Collaboration Branch, Office of Foreign Agricultural Relations, has been elected Director of the Inter-American Institute of Agricultural Sciences at Turrialba, Costa Rica, the position formerly held by Dr. Bressman. Mr. Allee has traveled widely in Latin America, was in charge of the Inter-American Tropical Institute Survey in 1941, and acted as Technical Adviser, Second Inter-American Conference on Agriculture, Mexico City, in 1942. He has been with OFAR for nearly 5 years.

Since the inception of the Food and Agriculture Organization at the United Nations Conference on Food and Agriculture held at Hot Springs, Virginia, in 1943, Mr. Allee has been actively connected with that organization, serving as Assistant Secretary General at the conference in Quebec in 1945 and In Charge of Scientific Information and Statistical Conference and Organization, Greek Mission, in 1946. He has recently returned from London, where he participated in meetings of the FAO. Mr. Allee will assume his new duties in Turrialba in the near future.

Dr. García Receives USDA Fellowship

Dr. Gonzalo García Castanedo, Agronomist for the Estación Experimental Agrícola, Tingo María, Peru, has come to Washington on a fellowship granted by the USDA. Dr. García will study horticulture and plant physiology.

Michael H. Langford Returns to Turrialba

Michael H. Langford, Pathologist, Bureau of Plant Industry, Soils, and Agricultural Engineering, who has been in charge of investigational work in the diseases of Hevea rubber at Belém, Brazil, has returned to the Cooperative Rubber Station at Turrialba, Costa Rica, where he is a member of the staff. He will continue to serve Brazil, Peru, Colombia, and other countries as required.

Leo R. Smith Assigned To Guatemalan Station

Leo R. Smith, formerly Food-Production Officer for the Office of Inter-American Affairs, has been appointed Extension Specialist in the Office of Foreign Agricultural Relations. He recently left for Guatemala, where he will serve on the staff of the Cooperative Agricultural Experiment Station.

Maki Goes to Costa Rica

Charles J. Maki, Agronomist, Division of Rubber Plant Investigations, B. P. I., has been assigned to the Cooperative Rubber Experiment Farm at Guapiles, Costa Rica, where he will assist with the experimental rubber plantings and other projects being carried on there.

Junker Assigned To Mexico

Fred H. Junker, Marketing Specialist, Production and Marketing Administration, has been temporarily assigned to Mexico, where he will carry on inspection work of canned tomatoes and tomato products.

Claud Horn Returns

Claud L. Horn, Acting Head of the Complementary Crops Division, Technical Collaboration Branch, OFAR, returned to Washington on April 25, following a field trip of 3 months in the Other American Republics. He visited OFAR's fiber projects in Cuba and the cooperative agricultural experiment stations in Guatemala, El Salvador, and Ecuador. With *Benjamin J. Birdsall* of the Peruvian station and *Olen E. Leonard* of the Extension and Training Division, he spent about 6 weeks in Bolivia investigating agricultural possibilities in that country prior to the establishment of a cooperative experiment station there. The Bolivian program will be built around basic food crops with long-time complementary-crop objectives.

Agriculture IN THE *Americas*

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Pan American Day Observance Stresses Agricultural Cooperation

The 1946 slogan "Free and United—the Americas Go Forward" expresses the spirit of cooperation among the Americas. Especially is this emphasized in agriculture.

by CARLOS J. ORTEGA

The close agricultural cooperation existing among the American Republics was further emphasized this year in the annual observance of Pan American Day with events and ceremonies which were not confined to the day alone but extended through the week of April 14.

This year's Pan American Day observance, first since the end of world hostilities, served to rededicate the spirit which has fostered good will and collaboration among the Americas for their common agricultural betterment in years past, and gave indication that further progress toward this goal may be expected in the future. The nature and character of individual Pan American celebrations varied, naturally,

Courtesy of Pan American Union

President Truman broadcasts his Pan American Day address before the Governing Board of the Pan American Union.

according to country and locality, but all were marked by the same feeling of international friendship and hemispheric neighborliness.

President Truman issued a proclamation that the week beginning April 14 be known in the United States as Pan American Week. At his request the United States flag was displayed on all public buildings during the week. The President called upon churches, educational institutions, civic associations, clubs, business establishments, and the people in general to observe this Pan American Week with fitting ceremonies, displays, exhibits, or other activities. Reminding the American people of the meaning of the occasion he said: "The exigencies of war have brought to the nations of the world new realization of their interdependence and new determination to join together to achieve a just and lasting peace and to promote and maintain the welfare, security, and prosperity of all peoples everywhere."

Agriculture Celebrates

A luncheon was given in Washington by Secretary of Agriculture Anderson and the Office of Foreign Agricultural Relations for the Agricultural Attachés and others interested in agriculture from the Latin American Embassies.

In his address at the luncheon, Secretary Anderson told the diplomatic guests that New Mexico, his home State, had much in common with the South and Central American countries. He explained that the Hispanic Southwest, of which New Mexico is a part, still has many of the customs, the culture, and to a great extent the language of what was New Spain, and that for these reasons he has always entertained the warmest friendship and good will toward the people of the Latin American Republics.

Agricultural exhibits were held in the patio of the Administration Building, United States Department of Agriculture. Diplomatic representatives chatted informally in the patio.

In regard to inter-American agricultural cooperation, Secretary Anderson went on to say: "Since agriculture is the basis of our Western Hemisphere civilization, it is axiomatic that the progress of the Americas * * * necessarily involves the strengthening of our hemispheric agricultural economy."

In reply, José L. Colom, Chief of the Division of Agricultural Cooperation of the Pan American Union, said: "It is a fact that agriculture is the basic industry of the Latin American Republics, and in the near future much of the industrial progress of these republics will be dependent on the degree of development attained in the improvement of the production and utilization of agricultural crops."

The guests representing the Latin American Republics at the luncheon were: Sr. Don Rodolfo E. Barbagelata, Argentina; Sr. Don German Rovira, Bolivia; Mr. Alpheu Domingues, Brazil; Sr. Don Mario Illanes, Chile; Sr. Don Guillermo E. Suárez, Colombia; Sr. Don Fernando Hazera, Costa Rica; Sr. Dr. Felipe Pazos, Cuba; Sr. Don Rafael A. Espaillat, Dominican Republic; Sr. Jorge Reyes, Ecuador; Dr. Don Felipe Vega-Gómez, El Salvador; Sr. Dr. Don Enrique López-Herrarte, Guatemala; Mr. Auguste Brisson, Haiti; Sr. Dr. Don Julián R. Cáceres, Honduras; Sr. Don Héctor Lazos, Mexico; Sr. Don Alberto Sevilla Sacasa, Nicaragua; Sr. Don Julio E. Heurtematte, Panama; Sr. Dr. César R. Acosta, Paraguay; Sr. Don Carlos Donayre, Peru; Sr. César Montero de Bustamante, Uruguay; and Sr. Dr. Don M. A. Falcón-Briceño, Venezuela.

It was extremely fitting that the United States Department of Agriculture should take an active and leading part in the 1946 Pan American Day celebration.

Through the cooperation of the Department of State, a series of broadcasts on the subject of agricultural cooperation among the Americas was beamed by radio to Latin America. A feature of these broadcasts was a special message by Secretary Anderson stressing the importance of joint action by the Western Hemisphere countries to bring about agricultural progress for their common benefit.

The broadcasts, in which officials of the Office of Foreign Agricultural Relations participated, discussed the purpose and nature of agricultural collaboration in general, the experiment-station, complementary-crop, and rubber programs, and outlined the

Mr. Ortega is a member of the staff of the Office of Foreign Agricultural Relations.

Secretary of Agriculture Clinton P. Anderson speaks at an informal luncheon given April 18, for Agricultural Attachés and other representatives of the Pan American Union countries. Seated at the first table (left to right) are José L. Colom, Chief, Division of Agricultural Cooperation, Pan American Union; Ross E. Moore, Chief, TCB, Office of Foreign Agricultural Relations; Alberto Sevilla Sacasa, Secretary, Embassy of Nicaragua; Hon. Julián R. Cáceres, Ambassador Extraordinary and Plenipotentiary of Honduras; Norris E. Dodd, U. S. Under Secretary of Agriculture; Paul L. Guest, Agricultural Attaché, United States Embassy, Santiago, Chile.

details of the program for the training of Latin American agricultural technicians in the United States.

The Department of Agriculture's contribution to the observance of Pan American Day also included an agricultural exhibit "The Americas Go Forward in Agriculture" in the patio of the Administration Building, a book exhibit featuring Latin American publications in the library, the showing of Latin American films in the auditorium, and Spanish-Mexican menus in the cafeterias.

The Cooperative Extension Service of the Department and the various States helped give impetus to the celebration of Pan American Day by assisting the 4–H and Home Demonstration Clubs in developing programs for appropriate ceremonies. Informational materials prepared by the Department, the Pan American Union, and the Council for Inter-American Cooperation regarding the history and meaning of Pan American Day were distributed by Extension workers to these groups. The interest in good-neighbor relationships and the customs and culture of the other Americas has been further stimulated by the foreign-student training program. The extension trainees from Latin American countries have received much of their training in the State Extension Service offices, in the course of which they attended many meetings of 4–H and Home Demonstration Clubs and discussed the life and customs of their own countries.

President Truman's Address

At a special session of the Governing Board of the Pan American Union, President Truman in a radio address to Latin America and the United States said: "During the 1930's the special part which the American Republics played in world history was to perfect and strengthen their methods of consultation and cooperation. They did this primarily to meet the growing threat of war from overseas. And when war finally came, the weight of the Americas was overwhelmingly on the side of the forces which defeated the Axis Powers."

In summing up his Pan American Day address he called upon the American Republics in the great task ahead "to do their part in creating and maintaining

(Continued on page 107)

Chile's Expanding Citrus Industry

Chilean plantings of citrus, almost entirely lemons and oranges, have expanded rapidly during the last few years. ¶ As Chile is south of the Equator, winter oranges ripen there in June, July, and August.

by PAUL L. GUEST
and GREGORIO ROSENBERG

Citrus fruit is grown commercially in Chile over a north-south airline distance of more than 1,300 miles, one of the greatest north-south distributions in any country in the world. Introduced by the Spaniards during the Conquest in the sixteenth century, citrus has long been grown around hacienda headquarters for household purposes. Limited commercial production has been carried on for many decades, but plantings, especially of lemons, have expanded rapidly during the past 5 to 8 years. These new lemon orchards have lifted Chile to possibly fifth or sixth place in world lemon acreage, based upon 1939 area estimates for other countries. To those familiar with California's citrus industry a striking resemblance is noted in Chile's main producing areas, particularly in climate, soil, and topography.

Without irrigation there would be no commercial production of citrus fruit in Chile. This spillway is located near Ovalle.

Producing Areas

There are at present, it is believed, about 14,800 acres of citrus in Chile, made up of some 8,600 acres of lemons and 6,200 of oranges. Thus, lemons account for about 58 percent of the total and oranges 42 percent. Only scattered trees of other citrus species are found except a few sour limes at Pica, an oasis-like town east of Iquique, and grapefruit, the commercial production of each being relatively insignificant.

The southernmost commercial plantings are in the vicinity of Angol in Malleco Province at about 38° S. lat., and the most northern along the Chilean-Peruvian border. The main producing regions, however, are situated within an area about 100 miles north and south of Santiago, Chile's beautiful capital. One of the principal centers, with about 3,500 acres, is located in the Peumo-San Vicente Valley, 70 miles south of the capital, and 6,500 acres are planted in the intervening area. Oranges and lemons have been grown commercially for many years in the Aconcagua Valley northwest of Santiago, especially near Quillota and Limache, where at present about 1,500 acres are estimated to be in citrus. Pica and most of the irrigated transverse valleys in northern Chile have commercial plantings which total a possible 1,100 acres.

All of these figures are rough approximations based upon personal observations, since accurate detailed statistics are not available. The Chilean Ministry of Agriculture is at present taking a census of all fruit trees in Chile, the results of which are expected to be released in 1946.

Estimates indicate that about three-fifths of the lemons and almost one-half of the oranges have been planted within the last 6 years, with greatest expansion during the past 2 or 3 years. This sudden increase is largely the result of high prices which prevailed a few years ago, making citrus attractive to Chilean farmers. Lemon expansion is still taking place, but, as many people are now becoming aware of the problems facing growers because of increased future production, new plantings may decrease sharply in the next few years.

A lemon known in Chile as the Genoa, the origin of which has not been established, is the principal variety, although the Eureka is also grown extensively. The Thompson Navel, Washington Navel, and a Chilean variety called Tuncana are the most popular varieties of oranges. The Tuncana is a prolific, high-quality, juicy variety with only a few seeds. Unfortunately all three varieties mature during the fall and winter—that means, between March and August, in Chile. Only within the last few years have extensive plantings of late oranges, such as the Valencia, been made.

Cultural Practices

There is a wide variation in the cultural practices followed by commercial citrus growers in Chile, ranging from almost no care to modern management techniques. Rapid strides have been made in recent years, largely due to efforts of the Chilean Ministry of Agriculture, and many of the newer groves particularly receive the best possible care based upon present-day technology.

Nursery practices in general are similar to those in California except that in many instances in the past not enough attention has been given to bud selection and the elimination of weak and off-type nursery seedlings. Although an overwhelming percentage of the very old citrus trees were seedlings, practically all of the commercial plantings during the past 8 years have been of trees budded on sour-orange stock. Chilean law requires that all citrus trees offered for sale must be budded on sour-orange stock at least 11.8 inches above the soil level as a protection against gummosis.

One-year-old balled trees are commonly used for establishing the groves. Trees are usually planted at the corners of squares, with distances ranging from

Dr. Guest was formerly Agricultural Attaché at the American Embassy, Santiago, Chile. Ing. Agr. Rosenberg is a member of the staff of the Department of Pomology and Fruit Technology, Chilean Ministry of Agriculture. He received the degree of Master of Science in subtropical horticulture from the University of California.

Citrus groves in Chile are often pruned severely, causing damage to the trees and reducing production. This lemon tree is an example of too-heavy removal of lower and inside branches.

about 17 by 17 to 28 by 28 feet for oranges and 15 by 15 to 24 by 24 feet for lemons. Although it can be done any time of the year, practically all planting takes place during the spring, from September to November.

Citrus has been planted on many types of soil in Chile, several of which are highly calcareous, but light-texture soils predominate. They range from about pH 5.5 in the most southern area to pH 7.0 to 7.5 and in some places as high as 8.0 in the Santiago section and northern valleys. Malnutrition symptoms, particularly chlorosis, indicative of both mineral deficiencies and excesses, are quite common in orchards on calcareous and high pH soils, but the specific minerals involved have not as yet been determined nor remedial measures worked out.

No regular fertilizer practices have been established, but the application of Chilean nitrate is quite common in all districts. Many growers apply some kind of animal manure during the year, or turn under

natural wood growth and occasionally a legume cover-crop as sources of organic matter. Some orchards are kept clean cultivated; in others the soil is worked only when weed growth gets high enough to interfere with other operations.

All commercial citrus plantings are under irrigation, since the average annual rainfall in the main centers of production is less than 20 inches, most of which falls during the brief winter period from June to September. Without irrigation very little citrus would be produced in Chile. Most of the water, the salt content of which varies considerably from river to river, is obtained by gravity flow from snow-fed rivers originating in the Andes. Canals, many of which have been in use for a century or more, are, for the most part, of dirt or stone construction. Young trees are irrigated by the basin system; both flooding and furrow irrigation, principally the latter, are used in bearing orchards.

Pruning the Trees

There is a tendency in Chile to prune citrus severely. Especially in older groves, trees are commonly seen pruned according to an upright, central-leader system or, in other instances, headed so high that a man can walk under them. The Chilean

Courtesy of Juan Theune

Props from 1 to several inches in diameter are used by Chilean growers to support the limbs of bearing citrus trees. Dr. Walter Ebeling, University of California Experiment Station (shown in the picture), visited Chile last year for the purpose of making a study of subtropical insects.

Ministry of Agriculture has been pointing out the folly of such practices, and most of the plantings during the past few years have received only a minimum amount of pruning.

Possibly as a result of pruning practices but also believed to be associated with other factors as yet undetermined, the main branches of bearing trees have to be propped up to keep them from breaking. This is necessary in practically all citrus districts and applies to both oranges and lemons. Five to eight poles ranging from 1 to 3 inches in diameter are used for each tree.

No particular effort has been made to establish windbreaks in most districts as apparently their need is limited to only a few areas. Frost protection is commonly provided 1- and 2-year-old trees by tying straw, corn stalks, or similar material around the trunk or by covering the entire tree with the material. Orchard heaters are not used as, according to such records as are available, destructive temperatures seldom occur in districts where old trees are found. The second-coldest temperature recorded officially in Santiago in 60 years, however, was experienced one night in June 1945, when the thermometer dropped to a little over 24° F. As a result a considerable acreage of young trees, particularly lemons, was frozen severely and many trees killed.

Citrus Pests and Diseases

Chile is blessed by having to contend with relatively few citrus insects and diseases. The only insect of widespread importance attacking the citrus trees, which are evergreens, is the purple scale (*Lepidosaphes beckii*), although the California red scale (*Aonidiella aurantii*) is now a serious pest in the Quillota region. The former is thought to have been introduced about 1860 and the latter near the beginning of the present century. Other pests of some importance include mealybugs, red spiders, thrips, and aphids.

Control measures consist of annual applications of a 1¾ to 2 percent oil spray, but spray rigs now in use have a maximum working pressure too low for most effective work.

The Chilean Ministry of Agriculture has recently completed a new modern insectary at Quillota, for rearing parasites of the black scale (*Saissetia oleae*) and citrus mealybug (*Pseudococcus citri*) and also parasites of insects which attack deciduous fruit trees.

Brown-rot gummosis is common on lemon and orange trees which have been budded or planted too low. The fruit also is attacked by brown rot, the

(*Continued on page 107*)

The Virgin Islands offer many beautiful scenes such as this one.

West Indian Conference Studies Caribbean Agriculture

Sixty miles east of Puerto Rico are the Virgin Islands, belonging to Britain and the United States. On St. Thomas, one of the United States group, was held, February 21 to March 12, the Second Session of the West Indian Conference, which serves as an advisory body for the Caribbean Commission.

by ERIC ENGLUND

Early in the war years the desirability of closer cooperation between Great Britain and the United States in meeting Caribbean wartime emergencies and in the social and economic development of the area became apparent. This was particularly true during the height of the submarine activity, when shipping was seriously hampered. The islands of the Caribbean, which generally depended on imports for a large part of their food, faced great danger of food shortage.

The Caribbean Commission

In response to this need for cooperation, the Anglo-American Caribbean Commission was established in March 1942, as an advisory organization for the purpose of "encouraging and strengthening social and economic cooperation between the United States of America and its possessions and bases in the area . . . and the United Kingdom and the British colonies in the same area. . . . " Within the past few months, the organization was expanded to include France and the Netherlands, and the name was changed to the Caribbean Commission.

One of the first tasks of the Anglo-American Caribbean Commission was to ensure food for the people of the islands. Arrangements were made for essential imports of food and for their safer and more efficient distribution in the face of the danger of submarine attack. The Schooner Pool, for example, was organized to assist in distributing food supplies among the islands, brought into particular ports by larger vessels during the war. Small schooners helped much in evading the submarine danger and in economizing on available shipping.

From the beginning of the organization, the Commission and the local governments have emphasized increased food production in the Caribbean area. The extent to which agricultural diversification and increased local food production will become a part of the postwar economy will depend upon many factors associated with the over-all problem of advantageous use of resources, consumer habits, processing and storing of food, and upon postwar commercial policies affecting the Caribbean. Agriculture is of basic importance to the economy of the area. Sugar, bananas, coffee, cocoa, essential oils, and many other agricultural products are among Caribbean exports, and agriculture yields directly a large part of the food supply of the people.

Caribbean Research Council

The Caribbean Research Council was created to furnish assistance to the Commission by stimulating scientific, technological, social, and economic research and improved dissemination of results. The Council was established in August 1943 at a meeting of the Commission on St. Thomas, convened to consider agriculture, nutrition, fisheries, and forestry in the Caribbean area. Specialists from the United States, Great Britain, Puerto Rico, the Virgin Islands of the United States, the British West Indies, and the Netherlands Territories participated in that meeting.

In recognition of the importance of agriculture, the first of the research committees established under the Council was the Committee on Agriculture, Nutrition, Fisheries, and Forestry. A provisional committee, appointed to act for both the Council and the Agricultural Committee, formulated a program for assembling information on research already done and for appraisal of the dissemination of results. A survey was conducted of various fields of agriculture and research institutions in the area and their status for research in various agricultural fields. A land-tenure symposium was held in Puerto Rico in the summer of 1944 dealing with land-tenure problems in the Caribbean and their bearing upon agriculture and rural life. Another symposium on forestry was held in Trinidad under the auspices of the Agricultural Committee in February 1946.

In September 1944 the provisional committee for the Research Council met on St. Thomas to formulate recommendations for broadening the scope of the Council along the lines proposed some months before by the West Indian Conference, first session. Their recommendations were later acted upon by the

Courtesy of Luis Hernández

Members of the Caribbean Commission—*Seated* (left to right): Sir John S. Macpherson, British cochairman, Comptroller for Development and Welfare in the British West Indies; Eugénie Eboué-Tell, French cochairman, elected representative of Guadeloupe to the French Constituent Assembly; Charles W. Taussig, United States cochairman; J. C. Kielstra, Netherlands cochairman, the Netherlands Majesty's Minister in Mexico and Guatemala. *Standing* (left to right): Jean C. de la Roche, French member, Head of Colonial Section of French Press and Information Service in United States; Georges H. Parisot, French member, Governor of Martinique; Rexford G. Tugwell, United States member, Governor of Puerto Rico; Robert D. H. Arundell, British Resident Member in Washington; L. A. H. Perers, member for the Netherlands, Agricultural Attaché to the Netherlands Embassy, Washington; Ralph J. Bunche, United States member, Acting Chief, Division of Dependent Area Affairs, Department of State.

Dr. Englund, who is Chief of the Regional Investigations Branch, OFAR, has been connected with the agricultural work of the Caribbean Commission since 1943—Chairman of the Meeting on Agriculture, Nutrition, Fisheries, and Forestry on St. Thomas, 1943; Chairman of the Provisional Committee for the Caribbean Research Council and of the sectional committee on agriculture from 1943 to 1945, when the Council was fully organized; Chairman of the meeting of the committee members and specialists on St. Thomas, September 1944. He attended the first session of the West Indian Conference at Barbados, British West Indies, March 1944, and the session just held at St. Thomas, as Adviser to the United States Section of the Commission. He is now a member of the Caribbean Research Council and of its Committee on Agriculture.

Commission, and the Research Council was fully established with the following five research committees: Agriculture, Nutrition, Fisheries, and Forestry; Public Health and Medicine; Industrial Technology; Building and Engineering Technology; Social Sciences.

Last February, the Commission announced the appointment of a full-time vice chairman of the Research Council, E. S. Pembleton, until recently Secretary to the British Section of the Commission. Dr. Eric Williams, a native of Trinidad, is research secretary to the Committee on Agriculture, Nutrition, Fisheries, and Forestry. The Second Session of the Conference, recently concluded, recommended a few additions to the staff of the Research Council to carry on its task of coordinating and encouraging research in the area. The Research Council, as yet, has no funds except those that may be allocated to it by the participating governments, and its functions are generally to recommend and facilitate the coordination of research chiefly within the institutions of the Caribbean area.

The West Indian Conference

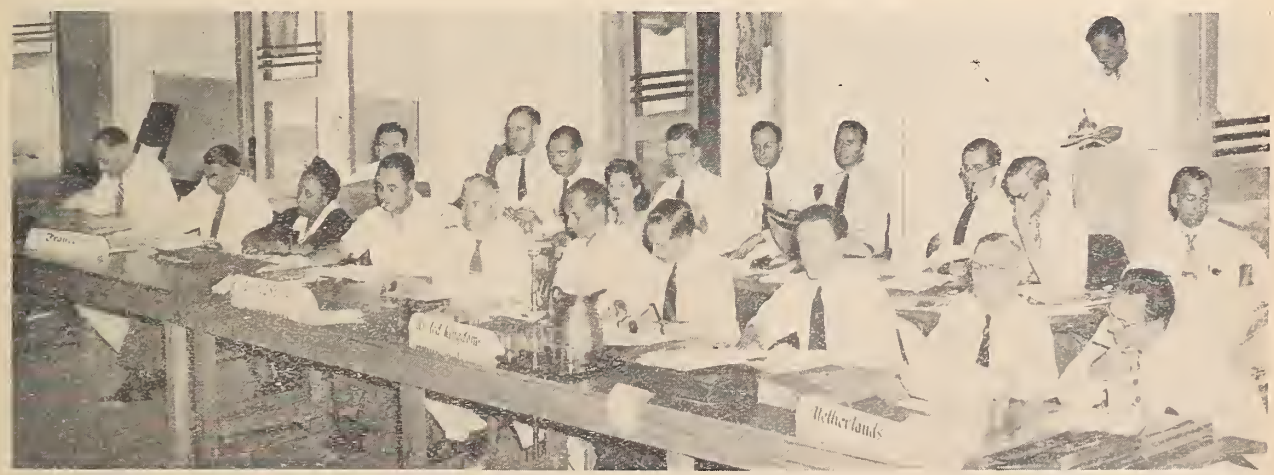
To facilitate the solution of Caribbean problems by consultation with the peoples of the area through local representatives designated as delegates by the territorial and colonial governments, the Commission organized the West Indian Conference, and the first meeting of this Conference was held at Barbados, British West Indies, in March 1944. The West Indian Conference is believed to be the first international organization of delegates from non-self-governing territories.

In the agreement creating the Conference, it was stated that "The Conference should be advisory but it would be hoped that it would attain a really influential position, and it would be open at any time to the interested Governments to agree among themselves to delegate to it any specific powers which they might think desirable." Technically speaking, the Conference has the power only to make recommendations to the Caribbean Commission, but in actuality its influence is broader to the extent that it exerts a direct effect upon public opinion and therefore on policies and programs in the area. Reports and recommendations drafted in the committee stage of the Conference and discussed and approved in plenary sessions are published and formally referred in due course to the metropolitan and local governments.

The Conference meets upon call of the Commission, thus far once in 2 years, when occasion demands discussion of subjects vital to the welfare of the Territories in the Caribbean area. The personnel of the Conference, designated by local governments, varies from Session to Session. The Chairman of the Session is the joint Chairman of the Caribbean Commission, from the country in whose territory the Session is held. The Chairman of the recent Second Session was Charles W. Taussig, United States Co-Chairman of the Commission, since the meeting was held in the Virgin Islands of the United States.

At the first meeting of the West Indian Conference, recommendations were made on many issues of agriculture, industry, trade, engineering, public health, and education, and on other social and economic

(*Continued on page 106*)



In the plenary sessions the delegates were seated around a large rectangle of tables. Inside the rectangle, opposite each delegation sat the advisers from the respective Territories and colonies. At one end of the rectangle, shown in this picture, sat the members of the Caribbean Commission. Those in the back are secretaries, assistants, translators, and others of the Conference personnel.

The Iowa State College Tropical Research Center

by CHARLES E. FRILEY

The Iowa State College is establishing a tropical research center at Antigua, Guatemala, for the study of crops originating in Central America which are of importance to Midwestern agriculture. The researches will relate primarily to the broader aspects of agriculture and the natural sciences, with initial emphasis on maize and other economic plants known to be indigenous to Central America and Southern Mexico. Following these studies, it is hoped the program may later be expanded to include the investigation of such other problems as new forage plants, erosion control, nutrition, and forestry.

Construction of the physical plant is under way and the center is expected to be ready for use by July 1. Preliminary negotiations have been going on for some months. The program will be developed in cooperation with a group of distinguished citizens of Guatemala, with the approval of the Guatemalan Minister of Agriculture.

Establishment of the research center climaxes two years of plant exploration and preliminary corn research, begun in Guatemala early in 1944 by Dr. Irving E. Melhus, Head of the Department of Botany and Plant Pathology at the Iowa State College, and Dr. George Goodman, formerly Associate Professor in the Department. Doctors Melhus and Goodman studied the corns and other plants in Mexico and Guatemala. Before they returned home, they made trial plantings at Finca Barcena in cooperation with the National School of Agriculture in Guatemala, in order to learn something of the responses of these plants in the regions where they are located. In addition, exploratory expeditions were made to

Courtesy of Eichenberger

Antigua, in colonial times the most important center between Mexico City and Lima, Peru, has been chosen as the site of the new research center in Guatemala.

the Guatemalan highlands in search of new corn varieties, teosinte and species of *Tripsacum*.

Antigua Selected

In the spring of 1945 Dr. Melhus and the President of Iowa State College went to Guatemala to consider the possibility of setting up a research center. Several sites were surveyed before it was decided to locate at Antigua. This city, formerly the capital of Guatemala and in colonial times the most important center between Mexico City and Lima, Peru, was chosen because of its healthful climate, accessibility to the capital city of Guatemala, its fertile lands and ready access to different plant zones, and diversity of temperate and tropical crops.

In August 1945 Dr. and Mrs. J. R. Wallin went to Guatemala to continue the field work and explorations that had been initiated the year before. The tropical research center will be administered by an advisory board consisting of representatives of the college and cooperative agencies in Guatemala. A resident director and staff will be maintained at the center during most of the year.

Cooperating with the college in the establishment of the center are the Hacienda Company of Guatemala, the Guatemalan Agriculture Association, the Ministry of Agriculture of Guatemala, the United Fruit Company, and the United States Department of Agriculture through its Cooperative Research Program with Guatemala. Plans are being made for close cooperation also with the United States Department of Agriculture's Office of Foreign Agricultural Relations. The work of the center will be financed largely from private grants, including that from Earl E. May, President of the May Seed and Nursery Company of Shenandoah, Iowa. The Hacienda Company of Guatemala will construct the buildings to be used for laboratory and living quarters. This company and the Guatemalan Government will provide such land as may be needed for experimental purposes.

Antigua lies in the fertile Panchoy Valley, at an elevation of about 5,000 feet, where tropical and temperate crops are grown throughout the year. The Guatemalan highlands, ranging in elevation from 7,000 to 9,500 feet, and the Pacific seacoast, with its tropical plantations of coffee, bananas, and other fruits, are within short distances of Antigua.

Dr. Charles E. Friley is President of Iowa State College Ames, Iowa.

Gamagrass, a member of the tribe to which maize belongs, growing on the highlands of Guatemala.

Area Well Suited To Research Work

In discussing the work of the research center Dr. Melhus says: "The Guatemala-Southern Mexico area is virtually unknown botanically and agriculturally. Further exploration should bring to light new information that will prove valuable to agriculture in Iowa and the Midwest and to the people of Mexico and Central America, whose basic food is corn." Dr. Melhus said further that the diversity of climate and topography in Guatemala makes it an excellent region for such research. There is much evidence that the region is the center of origin of many of our well-known cultivated plants such as the bean, potato, tomato, and ground cherry, as well as corn.

The initial efforts at the research center will be centered on corn. The Iowa State College has in progress a comprehensive research program in breeding, plant pathology, chemistry, botany, nutrition, and entomology, and the various kinds of corn in the Guatemala-Southern Mexico region afford new and little-known valuable types, including many varieties that have not been carefully studied.

Admission to the center will be limited to those students in the Iowa State College and other institutions who have shown unusual ability and interest in this particular field of research. The period of study will be from 3 to 9 months. Not more than 15 students can be accommodated in the beginning. Such students would be expected to have senior-college or graduate-college standing.

Details will soon be completed for the opening of the center, which is expected to take place on July 1, 1946.

CONFERENCE

(*Continued from page 103*)

fields. The Governments of the United Kingdom and the United States gave careful consideration to these recommendations and in large part accepted them as a basis for policy and action in the area. They received the approval of the President of the United States on June 11, 1945, and were later made public in a joint statement of the two governments.

Second Session of the West Indian Conference

Between the first Session of the Conference in 1944 and the second Session in 1946, both France and the Netherlands had been included in the Commission. Delegates from 15 Territories and Colonies, with a total population of about 5,500,000 were present. The Territories officially represented were: British—Bahamas, Barbados, Jamaica, Trinidad, British Guiana, British Honduras, Leeward Islands, Windward Islands; Netherlands—Curaçao, Surinam (Dutch Guiana); French—Martinique, Guadeloupe, French Guiana; United States—Puerto Rico, the Virgin Islands.

As at the first Session, much attention was again devoted to agricultural diversification, food production, human nutrition, and research, as well as to such subjects as plant and animal quarantine and soil surveys.

Great stress was placed upon the main objective of agricultural diversification, "to improve the general well-being of the people, both in relation to the maintenance of an adequate nutritional level and to the diversification of production for export." The group expressed the conviction that "crop diversification, in varying degrees, is a long-established feature of West Indian agriculture; during the last 50 years a wide range of crops has been investigated and it now appears that any increase in diversification will depend more upon the improvement of existing crops than upon the introduction of new ones." Emphasis was placed on the fact that even under conditions most unfavorable to diversification, appreciable quantities of animal products and other "protective" foods can be produced. In the conclusions and recommendations it was stressed that efforts for greater agricultural diversification should go beyond the generally recognized "broad principles leading to the best use of resources," and that their practical application to particular territories and situations "requires more detailed information than investigations and research have so far produced."

As relevant to this theme, considerable attention was given to such factors as intensive use of land, cheapest source of food supplies, significance of mixed farming, security of family income, and customs and habits of the people, urging the necessity of a land-utilization plan which should include provision for equitable distribution of land appropriate to particular areas. Soil surveys were urged as essential to the formulation of such a plan, as were also agricultural education, efficient methods of production, improved crop varieties and animal breeds, "assured markets both local and overseas," processing, storage, and refrigeration facilities, improved inter-territorial communications, credit facilities, and security of land tenure.

It was also stressed that the major export crops of the Caribbean region are likely to remain essential parts of a balanced agricultural economy, and that for these commodites the greatest possible market stability is necessary, both for the efficient use of agricultural resources and for the maintenance of the purchasing power of the region in world economy. The Conference, therefore, went on record as urging that "the world situation and outlook with respect to the principal export commodities of this region should be the subject of international discussion at the earliest possible date, with the object of arriving at an agreed international policy and specific programs respecting production, prices, distribution, and consumption."

Courtesy of Luis Hernández

Charlotte Amalie is the capital of the Virgin Islands of the United States. The buildings of the Marine Aviation Base near the city afforded assembly rooms, quarters, mess hall, and other facilities for the Second Session of the West Indian Conference.

CHILE'S CITRUS INDUSTRY

(*Continued from page 100*)

damage sometimes being severe. This is the only citrus disease of any commercial importance. *Tristeza* is not known to occur in Chile.

Harvesting and Marketing

The principal harvest period for both oranges and lemons is during late fall and winter, particularly the months of June, July, and August. Because of this seasonal production, citrus fruit is scarce throughout the summer. In general, yields are exceptionally high, especially when the trees have received good care, but the quality fluctuates. In one orchard about 4,000 oranges were picked from a prolific 45-year-old Tuncana tree last year. There is a tendency either to pick oranges while too immature or to hold the fruit on the tree until too late in the season, in an effort to gain a better price. Sometimes losses from rough handling are high. Lemons are allowed to grow rather large, based on California standards, because they are not picked, for the most part, until almost a full yellow color. Since there are few refrigerated storage facilities available for citrus fruit, it flows into consumer channels as harvested.

The price of both oranges and lemons in Chile has been good for a number of years, and this has brought about the rapid expansion in acreage since 1940. The usual practice in harvesting oranges is to sell the entire crop on the tree to a cash buyer just prior to the beginning of the harvest period, on the basis of a set price per fruit. In 1945, this ran from about 20 to 35 Chilean centavos, or about 0.65 to 1.15 U. S. cents, per orange. This provides an excellent return for the average production cost. The retail price of lemons in Santiago, the principal market, in 1945 varied from about 20 centavos to 1 peso each, or 0.65 to 3.23 U. S. cents, with the lower price prevailing much of the winter because of surplus production.

Courtesy of Juan Theune

A Chilean fruit grower in the Peumo district inspects his orange orchard.

Just prior to the war, Chile exported a small quantity of lemons annually, shipping out 368 tons in 1937 and 162 the following year. Since then, there has been practically no export of lemons. Oranges, on the other hand, are imported regularly during the Chilean summer. The average annual quantity imported amounted to 1,237 tons for the 3-year period 1941–43, almost all of which originated in Ecuador and Brazil.

Outlook

Because of rapid expansion of plantings, a large increase in the production of lemons in Chile is anticipated in the immediate future, a production much greater than the present market will absorb. What disposition will be made of the surplus has not yet been determined. By providing adequate storage facilities and by picking green instead of yellow fruit, the marketing period could be spread throughout the year.

Much of the new orange acreage is of winter varieties, whereas a greater summer production is needed. Although plantings of varieties which ripen during the Chilean summer are increasing, domestic demand for oranges in the summer apparently in still considerably in excess of anticipated production from trees now planted. There will, therefore, probably be a good market for summer oranges in Chile for a number of years to come.

Now possessing a well-trained staff, the Chilean Ministry of Agriculture is able to provide up-to-date technical guidance to citrus growers. By following such guidance, a marked improvement in cultural practices should be noted in future years.

PAN AMERICAN DAY

(*Continued from page 97*)

a system of world peace which will eliminate the fear of war and establish in its place a rule of justice and world cooperation."

Official Washington Observes the Day

The Department of Commerce called upon its 26 field offices to collaborate in Pan American Week programs and other activities planned by various

(*Continued on page 110*)

ALONG THE *Agricultural Front*

▲ Joint Food Study Planned for Caribbean Area

A nutritional research program to extend our knowledge of the composition of food lands in the Caribbean area will be carried on jointly by the Massachusetts Institute of Technology and the Pan American School of Agriculture of Honduras, which is sponsored by the United Fruit Company.

The project is an outgrowth of work which has been carried on by Dr. Robert S. Harris and others of the Institute, who, during the past few years, have made similar investigations in Mexico. The results of these studies show that the diets in Mexico are not as deficient as was previously supposed; in fact they may be superior in certain respects to the diet of many parts of the United States.

Instead of undertaking to provide the inhabitants of tropical countries with more milk, butter, and eggs, all of which are either difficult or impossible to produce in the Tropics it is desirable to develop in each country a diet which is easy to produce, and which may supply the necessary proteins, calories, minerals, and vitamins adequate for human nutrition. This diet would be cheap because it would be composed of native foods of high nutritive value.

The announcement points out that over the centuries the aboriginal inhabitants of the Mexican highlands, by a process of trial and error, have learned to utilize in their diet native plants of unusual value. One plant, known as malva, which contains vitamins in great variety and quantities, is of special value. It is hoped and expected that other plants may be found in Middle America which have unusual dietetic value.

Data on the investigation now beginning, which includes specimens of all edible plants in Middle America with complete information on their characteristics, distribution, and uses, will be sent to the laboratories of M. I. T. in Massachusetts for analysis by nutritional biochemists.

The Pan American School of Agriculture, which will collaborate with M. I. T., provides free tuition, board, and other benefits for students from all parts of Middle America, who are taught to carry on research in every aspect of theoretical and practical agriculture and forestry.

▲ Inter-American Education Workshop, Denver University

The University of Denver announces that it will hold the fourth of its summer Inter-American Education Workshops from June 17 to July 19. Samuel Guy Inman, noted author and lecturer, who is now directing an Inter-American labor conference for our government, will return as chief consultant on Inter-American affairs. Director of the Workshop will be Dr. Wilhelmina Hill, and the staff will include other teachers and internationally known lecturers.

The workshop sessions will be concerned with major problems of better Inter-American relations. Teachers, supervisors, and curriculum workers are especially invited, to gain further insight into Inter-American relations and to develop instructional techniques and materials for teaching about the Latin American Republics and our relation to them. Cooperative study-group work will be encouraged. Recreational events will include several mountain trips.

Conversational language groups will make it possible for the Workshoppers to learn, or to improve their use of, Spanish or Portuguese. Seminars will be held twice a week for language teachers who wish to consider improved methods of teaching these languages.

▲ Warehouses Opened In Dominican Republic

The General Depository Warehouses, *Almacenes Generales de Depósito*, of the *Banco Agrícola e Hipotecario* opened for business early in December. These warehouses will enable Dominican producers and exporters of agricultural products to store their goods for a period of 6 months at reasonable rates. Loans may be obtained at low rates from the bank, using the stored commodities as security. Certificates of deposit and warrants, each of which is negotiable, are issued by the warehousing branch of the bank. Local manufacturers and importers may also use the facilities of the warehouses.

RIVER BASINS

(*Continued from back cover*)

The climate of the entire region is hot and humid, with relatively little relief even in the interior highlands. Temperatures are monotonously high from day to day. Variation between day and night temperatures is about 10° F., which is more than the variation in the monthly averages. The temperatures at Georgetown, capital of British Guiana, are typical of the coast: The annual average is 80.6° F., ranging from 82.2° in September, the hottest month, to 79.3° in January and February, the coolest months. The heat is tempered somewhat by trade winds. Rainfall in that city averages 87.8 inches a year and humidity 79 percent. Rainfall in the highlands averages much higher than this, whereas in the intervening savannas it is much less, the greatest rainfall occurring between December and July.

Along the coasts, where most of the agriculture is concentrated, the clay or clay-loam soils are fertile but heavy and hard to cultivate. Much of the lowland is marshy and subject to inundation. The alluvial lands gradually merge into sand and clay hills and then into heavy reddish clay in the interior. Except on the coastal lands and strips of sandstone savanna, most of the vegetation is tropical rain forest.

People and Resources

Much of the fertile soil, the minerals, and the forest products are in the basins drained by the rivers. The rivers influenced the pattern of settlement greatly, drawing clusters of people around the estuaries along the coast. Unlike the rest of South America, the Spanish and Portuguese did not colonize the Guianas. Rather, the territories became pawns in the numerous colonial skirmishes among the British, Dutch, and French. Today all three of these peoples retain a foothold on the continent through control of this area comprising 175,000 square miles. British Guiana is the largest colony and probably the most important economically, with French Guiana falling at the bottom of the list. French Guiana is noted principally for its penal colony, located on Devil's Island just off the coast. The combined population of the three colonies is approximately 600,000. A comparatively small number are European whites. Negroes and mulattoes, descendants of the early slaves, East Indians, and Javanese make up the bulk of the total. The capitals of the three colonies—Georgetown, Paramaribo, and Cayenne—are the principal cities, most of the other settlements being classed as villages.

Tobacco and, later, sugar production made these colonies attractive to the ruling powers of Europe. Today, however, the product of greatest export value is bauxite, a material used in manufacturing aluminum. The British and Dutch Guianas are the world's principal source of bauxite, furnishing more than 90 percent of the bauxite imported by the United States. The principal producing centers in British Guiana are along the Demerara and Berbice Rivers, and in Surinam are up the Cottica River from Paramaribo and in the Para River and Para Creek districts. Gold is another important mineral, and deposits of silver, marble, phosphates, iron, mercury, antimony, plumbago (graphite), diamonds, sapphires, and garnets are found. All three colonies have gold resources, but British Guiana is the only one of the three with known deposits of diamonds. The Mazaruni, east of the Pakaraima Mountains in the northeast, is the best known field. Timber from the forests has not been extensively cut, although there are stands of valuable cabinet and other woods. The principal forest product to date is balata, a type of rubber used for covering golf balls and cables.

Transportation

The rivers are practically the only highways to inland Guiana. Forest products, gold, and bauxite move to the ports by rivers and streams. Bars, rapids, and falls, however, make transportation hazardous. Silt carried by the ocean northwestward from the mouth of the Amazon by the prevailing current is deposited along the Guiana coast, resulting in bars that are difficult to break through. On the upper rivers sheer falls and cataracts provide beautiful scenery but prevent the movement of traffic. Kaieteur Falls, on the Río Potaro in western British Guiana, drops 741 feet in a perpendicular column to produce one of the highest falls in the world.

There are not more than 225 miles of railroad in the whole area, slightly more than 100 miles each in British and Dutch Guiana, and about 10 miles in French Guiana. Roads are scarce in all three colonies. British Guiana has the largest mileage with about 300 miles of roads passable by automobile.

Agriculture

Except for the shifting subsistence farming of the Negroes and Indians in the interior, all agriculture is on the coasts and inland for a few miles along the rivers. Less than 250,000 acres are under cultivaton in the three colonies, or about 0.2 percent of the total area. Both in Surinam and in British Guiana, which the Dutch formerly occupied, agriculture on the coast is made possible only because of a system of embankments, canals, and sluices inaugurated by the Dutch. The coastal region in French Guiana is somewhat higher and does not require drainage. Agriculture is little developed there, however, and the colony must import much of its staple food requirements. Economic activity is centered largely in gold mining and the collection of forest products.

Before the war increased the demand for bauxite, sugar, and other agricultural products provided the largest part of the Guianan exports. Most of the people are still engaged in agricultural pursuits. As in other Caribbean areas, emphasis was placed on sugar plantations by the early settlers. Cotton and, later, coffee, cacao, and coconuts were cultivated, but they have declined in relative importance.

Sugar, practically all produced on large estates, is today the most important export crop in the British and Dutch areas, with rice second. The combined sugar crop is about 175,000 short tons and the rice crop in the neighborhood of 160,000,000 pounds. Rice is grown on the banks of the rivers and the lower areas of the plain where the tropical rains supply enough water to flood the fields. It is one of the principal foods in the Guianas and so far is grown largely for local consumption, as are corn and yuca. Bananas, citrus fruits, and garden vegetables are also raised locally. Coconuts and limes have been exported in small quantities. The important food imports into the area include wheat flour, cured meats, dairy products, and fats. The livestock industry is little developed, the whole region having less than 200,000 head of cattle. British Guiana has the largest number, with Surinam second. Parts of the savanna are used for pasture in British Guiana, whereas in Surinam they cannot be so used presumably because of inferior soil fertility.

Since the latter part of the nineteenth century labor has been scarce, particularly for work on the sugar plantations, and agricultural production has not expanded in line with early plans. Both the home and colonial governments, however, are interested in agricultural development, and government assistance may lead to improvements. Focal points for such development will continue to be the lower reaches of the numerous rivers.

A Naturalist in Cuba, by Thomas Barbour. 317 pp., illus. An Atlantic Monthly Press Book; Little, Brown & Company, Boston, Mass., 1945. Dr. Barbour has written this book from a first-hand knowledge of Cuba. He has explored the caves, coves, and streams of the island and has made friendships with the people. From his experiences we learn of the place of the Royal palm in Cuban life as furnishing material to build the *bohíos*, or cabins, and yielding *palmiche*, or fruit clusters, which are food for the hogs; of tobacco sinks, or *hoyos*, with their sides a thousand feet deep; of the cooling fruit drinks made from tamarind, soursop, sweetsop, crushed pineapple, and citrus fruits; of the Cuban diet; of the Harvard Botanical Garden at Soledad; and of Cuban agriculture, particularly sugarcane and tobacco.

El Problema Económico de Cuba, by Rogelio Casás Cadilla. 48 pp. Imprenta Compañía Editora de Libros y Folletos, Habana, Cuba, 1945. This is the fifth edition of the same booklet brought up to date annually. It covers fiscal reform, free trade, value of land, social organization, and a number of other subjects related to the economic development of Cuba.

People and Politics in Latin America, by Mary Wilhelmine Williams. 961 pp., illus. Ginn and Company, Boston, Massachusetts, 1945. This is the second revision of a very dependable textbook, brought up to date by Ruhl J. Bartlett after the death of Miss Williams. It is still one of the outstanding works on Latin America, embracing the geographic setting and the history of the peoples from prehistoric times to the present. A new chapter on Latin America and the Second World War has been added.

Editor's Note.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

PAN AMERICAN DAY

(*Continued from page 107*)

organizations in their districts. In addition, the Department lent active support to a wide variety of commemorative programs worked out by the Council for Inter-American Cooperation, Inter-American Centers, and the International Centers.

It made available appropriate films and program and display materials and arranged for distribution of special studies of the economies of the Latin American countries, as well as reports on Latin American travel. Secretary of Commerce Henry A. Wallace was host at a reception April 16 to a group of trainees in government from all parts of Latin America. There was a special Latin American exhibit in the main lobby of the Commerce Building, and menus offering Latin American dishes were served in the cafeterias.

Congress recessed on April 15 in honor of Pan American Day. Other agencies participating in the Pan American observance included the Department of State, the Office of Education, the Library of Congress, and the Smithsonian Institution. They made materials available for programs in schools, libraries, and museums throughout the country.

Western Hemisphere Unites in Celebration

Throughout North, Central, and South America, the people of the Western Hemisphere countries showed enthusiastically, and in individual ways, their belief in international friendship and cooperation, and their desire for continuance of the existing cordial relations and solidarity among the Republics.

In some of these countries Pan American Day is a national holiday, while some Republics devote a week to celebration of the anniversary of the formation on April 14, 1890, of the Pan American Union for the promotion of good will and the economic advancement among the Americas.

Our Good Neighbors to the south held colorful fiestas with dancing and singing; schools held exhibits, debates, and plays suggestive of the many close ties in the Western Hemispheric "neighborhood." National flags were displayed on all public buildings, and many ceremonies were featured by inspiring addresses.

AGRICULTURE IN THE AMERICAS — O. R. CARRINGTON, EDITOR

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Gifts of the Americas

THE VICUÑA

by MARJORIE FRYCKBERG

If ever the proverbial camel is to pass through the eye of a needle and give the rich man hope of heaven, it might well be the tiny vicuña—smallest and rarest of the South American Camelidae. This delicate creature, which is indigenous to the Western Hemisphere, makes its home high above the clouds in the remote wastes of the Andes Mountains.

In the past, only the wealthy could possess vicuña fabric, but recent efforts to domesticate the animal may mean a substantial increase in the supply of vicuña wool for world trade. Reports from Peru indicate that several hundred vicuñas are withstanding domestication and are being sheared in the same manner as sheep. Previously the wool of this wild little animal could be obtained only by killing it. Ruthless hunting since the Spanish conquest of the Incas almost exterminated the vicuña, and only in recent years has the number begun to increase. Today there are many thousands of vicuñas in Peru and Bolivia, and some in Argentina and Chile.

The ancient Incas esteemed the vicuña almost with veneration. Hunting was forbidden on pain of death except once in 4 years when a great national *chacu* or round-up was held. Several enclosures were made with ropes decorated with brightly colored bits of cloth. Thousands of hunters would comb the countryside, driving the animals into the enclosures. The females and younger males were released but the older males were brought to the ground with *bolas* (sling weapons made of rope and heavy balls) and then killed. The valuable skins were then sent to the royal warehouse, and the flesh was divided among the hunters for food.

The extremely soft and precious wool obtained from the vicuña was woven into fabric by the Virgins of the Sun, who devoted their lives to making garments for the high priests and rulers. Specimens of this fabric are today prized museum possessions. The fineness of texture and beauty of design almost defy description and have never been surpassed even in the finest loom-woven damasks.

Seemingly more akin to the gazelle or mountain goat than to the ponderous camel, the vicuña weighs between 75 and 100 pounds and is about 3 feet high at the shoulders. It has a long slender neck, large expressive eyes, and slim legs. The highly prized wool is golden brown on the back, shading to white underneath the body. An apron of long white hair falls from the breast to the forelegs. The vicuña is both cloven-hoofed and a ruminant. Although inured to extreme cold and needing little water or oxygen, the vicuña lacks the camel's disfiguring hump.

Leisurely and ceaselessly the vicuñas graze on small alpine shrubs and plants, traveling in flocks of 6 to 15 females and 1 male. The young bucks, forcibly evicted from the flock at 6 months of age, roam in groups until they are a year old, when they return to fight for their own pack of females. When danger threatens, the males emit a warning whistle and the entire flock retreats hastily but in orderly fashion. When the animals in a flock are fighting among themselves, a vicuña kicks, bites, and spits explosively, perhaps to blur the vision of the opponent. If a male is wounded, the females gather around solicitously, and are an easy prey for the hunter. If a female is wounded, the entire flock moves on unheeding.

Vicuña wool looks like a bit of amber mist when held between the fingers. The hairs are one-half the diameter of the finest sheep wool. Although short stapled they are strong, resilient, and elastic. The original wool requires many hand pickings and combings, and the surface of the fabric must be napped and sheared hundreds of times—a process requiring about 2 weeks. Most often used in its natural color, vicuña wool can be dyed, although not easily. About one-fourth of a pound of wool is obtained from one animal, and the wool from 40 vicuñas is needed to make one overcoat.

The United States is the largest importer of vicuña wool. Before the war two manufacturers produced approximately 2,000 yards of cloth, valued at $75 a yard. The sale of vicuña robes has been restricted in most South American countries in order to protect the animal from extinction. Robes cannot be brought into this country without permission of the United States Government.

With the return of peace and the emphasis that is being placed on the domestication of the vicuña, it is hoped that this valuable wool will take an even more important place in the commerce of the Western Hemisphere.

RIVER BASINS OF THE GUIANAS

by KATHRYN H. WYLIE

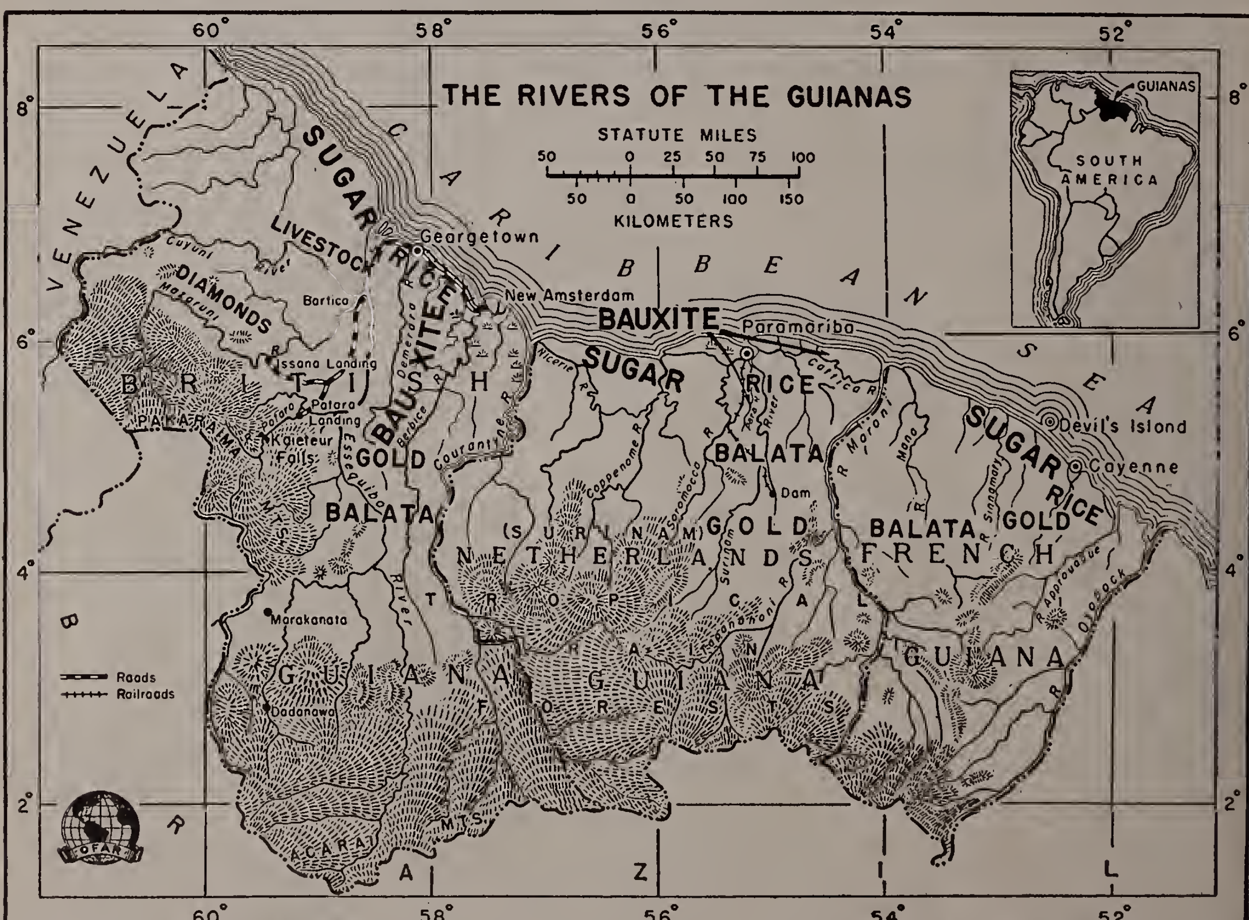
The three Guianas, lying between Venezuela and Brazil on the northeastern coast of South America, are the only European possessions on that continent. Numerous rivers water these lands, most of them rising in the south and flowing northward. Although there are wide differences in soil composition and fertility as well as other physical characteristics among the three possessions, they have a more or less similar configuration—swampy coastal lowlands, an interior savanna dotted by sand dunes, and still farther inland a highland region of flat-topped mountains. These highlands form the watershed of most of the rivers and streams that cross the crystalline hilly uplands on their way to the Atlantic Ocean. Three of these rivers serve as boundaries: the Corentyne separates British and Netherlands Guiana, which is known as Surinam; the Maroni runs between Netherlands and French Guiana; and the Oyapock River forms the boundary between the French colony and Brazil.

The largest river system is the Essequibo and its tributaries. The main stream rises in the Acarai Mountains, flows north through British Guiana for 600 miles, where it is joined by the Mazaruni and the Cuyuni, and then empties into the Atlantic a few miles up the coast from Georgetown. It drains nearly all of the interior of British Guiana. The shorter Demerara River, however, is more important economically since it goes through an area of denser settlement.

Rising in a divide 400 to 600 feet high far to the south, the Corentyne River travels north across Surinam and on to the sea between the British and Dutch colonies. It is navigable for about 100 miles from its mouth, and its estuary is 14 miles wide. In addition to its other boundary river, the Maroni, Surinam has three more important rivers—the Coppename, the Saramacca, and the Surinam.

With the exception of the two boundary systems, the rivers of French Guiana are relatively short, draining north to the Atlantic.

(*Continued on page 108*)



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August 1946

NAMES & NEWS

William Mackinnon Assigned to Colombia

William Mackinnon, Cooperative Agent (Sr. Agronomist), Division of Rubber Plant Investigations, Bureau of Plant Industry, Soils, and Agricultural Engineering, USDA, has been assigned to the Cooperative Rubber Program in Colombia, which is being carried on under the Memorandum of Agreement between the Ministry of National Economy of Colombia and the USDA. Mr. Mackinnon will serve as project leader to guide the plantation developments and permit *Wallace E. Manis,* who has been acting In Charge, to undertake needed investigational work which should be coordinated with the plantation program.

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Lafaurie, Martínez Baca, Alvarez Study Soil Conservation

Señor José V. Lafaurie, Chief of the Soil Survey Section of the *Instituto Geográfico Militar y Catastral* of the Republic of Colombia, and *Señores Gustavo Martínez Baca, Jr.,* and *Manuel Alvarez,* Agricultural Technicians from the Department of Soil Conservation of the *Comisión Nacional de Irrigación* of the Republic of Mexico, have joined the Soil Conservation Service in Washington to begin a year's training in the practices of soil and moisture conservation.

•

USDA Aids Army in Brazilian Mosquito Control

Christian C. Deonier, Alan Stone, William C. McDuffie, and *Claude M. Gjullin,* Entomologists, Bureau of Entomology and Plant Quarantine, ARA, are in Brazil at the request of the United States Army, to assist in planning and directing a mosquito-control program at Belém. It is proposed to test the effectiveness of water-dispersible DDT as a mosquito adulticide and larvicide when sprayed from an airplane.

Kowal and Dews Inspect Termite Control, Canal Zone

R. Joseph Kowal and *Samuel C. Dews,* Entomologists, Bureau of Entomology and Plant Quarantine, ARA, United States Department of Agriculture, have gone to the Panama Canal Zone to examine results of a series of standardized tests to determine the most effective methods and materials for the protection of buildings and other constructions in the American tropics against attacks by subterranean termites. These tests were installed by Mr. Kowal in 1943, and they have been carried on in cooperation with the Bureau of Plant Industry, Soils, and Agricultural Engineering and the Forest Service of the Department of Agriculture. Mr. Kowal and Mr. Dews will also examine tests in the injection of chemicals into the sap stream of living trees to determine the feasibility of using this method for the protection of tropical woods from attack by termites.

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Dorothy E. Chapman Goes to Cuba and Guatemala

Dorothy E. Chapman, Plant Anatomist, OFAR, has gone to Cuba to establish a technique for testing fibers and to instruct one or more Cuban technicians in this process. This project is being carried on under agreements made between the Governments of the United States and of Cuba. After some months in Cuba, Dr. Chapman will go to Guatemala to serve as Plant Anatomist on the staff of the Cooperative Agricultural Experiment Station in that country.

•

Ernest W. Laake Addresses Livestock Association, Mexico

Ernest W. Laake, Entomologist, Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, USDA, addressed the convention of the Southwestern States and Republic of Mexico Livestock Sanitary Board Association held at Hermosillo, Sonora, Mexico, in April. Dr. Laake has been in charge of the Bureau's research on the use of DDT for the control of insects on cattle in the Southwest, and he was invited by the Association to present his findings in that research.

Agriculture IN THE *Americas*

Vol. VI · AUGUST 1946 · *No. 8*

Tea in Place of Gold

Instead of the legendary gold of 150 years ago, tea is bringing income to Brazil's mountainous State of Minas Gerais. Tea plantations cover the steep slopes and furnish a growing industry for the Ouro Preto and Mariana communities.

by KENNETH WERNIMONT

Tea gatherers have replaced gold prospectors at Ouro Preto. Gold is legendary in the history of this picturesque old city located deep in Brazil's mountainous State of Minas Gerais. Its prospecting townspeople gained both fame and fortune from the precious metal during the eighteenth and early nineteenth centuries. To display their wealth, they built palaces and religious shrines, which are still considered to be among the finest examples of Brazilian art and architecture.

Little did these builders think in 1825 that an ornamental tea bush brought from Rio de Janeiro that year to be planted in a monastery garden would found an industry capable of outranking gold as a source of income for the community. But Ouro Preto has suffered the molding decline of most "boom towns" and little remains today of gold except the shrines and the memories, while tea has developed into a substantial enterprise. Thirteen plantations in the county and two in the neighboring county of Mariana support a total of 4,000,000 bushes, which will yield an estimated 175,000 pounds of processed black tea this season.

Tea found its way to Ouro Preto from an early introduction into Brazil through a shipment of exotic plants for the Royal Botanical Garden at Rio de aneiro in 1812. King João VI became so intrigued with the possibilities of the product that he sent to China in 1814 for workers who could teach Brazilians about tea growing and tea processing. As the plantings in the Royal Garden grew in size, the domestic tea became familiar in Rio de Janeiro homes, and interest in its culture spread to other parts of the country. By 1850, it had achieved some importance as an item of trade at Ouro Preto. A parallel development occurred in the coastal municipalities of the State of São Paulo.

In both areas a period of decline set in after 1850, which was accentuated by labor problems after the abolition of slavery in 1888. It was only in 1920, after the economic upheavals of World War I, that growers renewed their interest in tea to the extent of attempting well-organized expansion of plantations and improved methods of processing. Most of the boxwood-green bushes which today insulate Ouro Preto's worn and stony mountain tops have been planted in the last 15 years.

Plantation Production

The soil on which these bushes grow is acid with considerable quantities of mineral compounds such as iron, manganese, and potassium. Although the soil is poor in organic matter, tea bushes flourish over long periods of time without benefit of fertilizers.

Most of the plantations are on steep slopes near the tops of the mountains at altitudes above 4,000 feet. Temperatures at this altitude average 64° F., ranging from minimum temperatures around the freezing point to maximums of more than 90° F. Relative humidity is always high, with annual rainfall of more than 60 inches. The rainy season begins in November and continues through April, with very little precipitation from May to September. Plantations are often enveloped in fog during the rainy season.

Mr. Wernimont is Agricultural Commissioner at the Consulate in Rio de Janeiro, Brazil.

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Most of the tea plantations are on steep slopes near the tops of mountains.

Tea bushes are grown from seed, the two prevailing varieties being Chinese and Assam. The Assam variety was introduced from India about 1925 and is generally preferred because it gives somewhat higher yields than the original Chinese, while the quality of the finished tea is said to be the same. In actual practice, growers do not maintain pure strains of either variety, and scientifically conducted variety tests are lacking to guide their selections.

Tea seed is picked in April and early May from selected bushes on the individual plantations. It is first spread out to dry for a short period and then planted in nursery beds. The seedlings are ready to transplant in the fields by November or December, when they have reached a height of 12 to 15 inches. Holes for field planting are carefully prepared, averaging 10 inches square and 10 inches deep. The plants are spaced at intervals of 4½ feet in each direction.

When the tea bushes are 2 years old they are pruned for the first time. Pruning gives a table-top effect, facilitating picking as well as encouraging the production of more shoots. Prunings are made during June and July at a height of 2½ to 3 feet.

Bushes bear their first flush of leaves suitable for processing during the second season, and some of the bushes on the Ouro Preto plantations are still bearing at a reputed age of 90 years. The picking season begins in September and continues through May. Each bush provides from two to four flushes of new leaves per month, depending upon the rains, temperatures, and the number of days of sunshine. Average production per bush is 20 grams of processed tea each season. Seasonal production reaches its peak in the month of February.

Most of the picking is done by women who carry bamboo baskets slung over their shoulders. Picking is a highly selective process since only the new green shoots with two leaves may be chosen. Less careful plantation owners allow the picking of up to three leaves but this tends to make the finished product coarse. Pickers average 40 pounds of leaves a day, whereas the most skilled are able to pick 65 to 75 pounds a day. Forty pounds of green leaves are equivalent to 10 pounds of processed tea.

Processing

The first step in tea processing consists of spreading the green leaves on flat bamboo trays for withering. The trays hold about a pound and a half of leaves and are placed on racks with a spacing of 8 to 10 inches. In ordinary weather, the withering is a natural process with leaves remaining 12 to 18 hours on the trays. A simple test of bending the petiole is used to determine when the withering is complete. If the petiole bends without breaking, the leaves are ready to be delivered to the rollers. In rainy weather trays are removed to a brick chamber where arti-

ficial heat is applied by means of a centrifugal ventilator blowing in air heated to the temperature of 77° F. Artificial withering produces a lower quality of tea than does the natural process.

After withering, the leaves are carried to the rolling machine. They are poured into a hopper at the top and gradually worked down on a flat iron plate where they are subjected to a rotary rolling movement. From the rolling machine the leaves are put over a coarse sieve. Being moist, they have a tendency to bunch in rolling, and the sifter breaks up these bunches. It also takes off the coarse, less perfectly rolled leaves, and these are put back through the machine. The leaves which pass through the sieve are ready for the fermentation chamber.

The fermentation chamber contains a series of shallow cement tanks, which are kept meticulously clean. The chamber itself is so built as to avoid dust and foreign odors. Temperature and humidity are closely controlled through vaporizing with live steam. Tea leaves remain in this chamber from 5 to 8 hours. Fermentation is said to be the most important step in the manufacturing of tea because of its effect on the quality of the finished product.

From the fermentation room, the tea leaves are next taken to an oven for firing. Here they are spread on a series of racks through which hot air is forced. From the oven the dried tea is poured out on a table where workers pick out by hand foreign matter such as sticks, stones, and old or badly rolled leaves. The selected product is then ready to go to the cutter, a small machine resembling a feed grinder. From the cutter the tea is taken to a sifter, which sorts out three types: first quality tea, coarse tea, and powdered tea. Powdered tea constitutes about 2 percent of the entire production. Coarse tea constitutes a very small percentage, and some plantations follow the practice of putting it back through the cutter until it will pass the first quality sieve. Other plantations do not separate the coarse leaves from the first quality leaves.

Tea in Trade

Finished tea is packed in large 220-pound-capacity cylindrical cans at the plantations. In this form the product is transported by truck or muleback to the towns of Ouro Preto and Mariana, where each firm has its own small warehouse. In these warehouses, the tea destined for domestic consumption is put up in 50- and 100-gram celophane-wrapped packages. Tins were used before the war, but the celophane wrapping has been so satisfactory that most packers do not expect to go back to using tin even when it becomes available again. Export tea is packed in plywood boxes containing an average of 150 pounds each. Prewar packing required a lining with aluminum foil. For this, heavy brown paper has been temporarily substituted, which is considered to be only partially satisfactory.

The demand for tea in Brazil is limited. Its greatest popularity is in the larger cities where the foreign communities are the most enthusiastic consumers. Tea imports, chiefly from Great Britain, have fallen off considerably since 1928, when they reached a peak of 600,000 pounds. The quantity imported in 1944 was 94,000 pounds. Exports have steadily increased from less than 1,000 pounds in 1937 to more than 500,000 pounds in 1944.

Average production of tea in the State of Minas Gerais for the period 1939–43 was 137,500 pounds. It has shown a steady increase since the beginning of World War II and while it is still far below the 800,000-pound yearly average of production in the State of São Paulo, it has proved its worth in the economy of the Ouro Preto and Mariana communities. Plantations in these communities expect to continue making a proportional contribution to the expanding export market.

The tea leaves are picked by women who average 40 pounds of leaves a day.

These run-off plots in Mayaguez, Puerto Rico, record the quantities of soil and water lost on a 60-percent slope of Mucara clay soil. Records kept by technicians have helped in making recommendations for soil conservation practices on coffee plantations.

Saving Puerto Rican Coffee Soil

The story of coffee as the ruling crop in Puerto Rico and the resulting erosion damage recalls the history of King Cotton in other countries. Today the Soil Conservation Service is striving to avoid that damage and to raise even better coffee.

by EMERY A. TELFORD

Coffee is no longer king in Puerto Rico, but the erosion caused to the land during the peak of coffee's reign in the nineteenth century still is apparent on the eroded slopes of the island. Today, however, the Soil Conservation Service of the U. S. Department of Agriculture and other agencies have demonstrated that coffee can be grown without appreciable soil erosion.

The first coffee plants brought to the islands of the Caribbean came in 1720 from the Paris Botanical Gardens and were identified as *Coffea arabica* L. In Puerto Rico seed from these plants were first sown in 1736. This variety found an ideal environment in the virgin, fertile, clayish mountain soil, warmed by the tropical sun, and tempered by the trade winds. Soon large tracts of land were established in coffee.

In the early years of coffee culture, the trees were planted on the gentle slopes which had been in forest

for centuries. These soils were rich in organic matter. The small coffee trees, under the shade of the other trees, grew and produced abundantly. The use of chemical fertilizers in coffee cultivation was unknown before 1900, although there are records of progressive growers who placed stable manures, crop residues, bonemeal, and fish refuse near the trees in shallow holes. The soil was intensively cultivated and four times a year the slopes were weeded by the use of plows, hand hoes, and machetes. Eventually the organic material was depleted, and the heavy tropical rains washed ever-increasing amounts of the unprotected topsoil into the rivers.

As the coffee trees became unproductive, the owners moved their plantations farther into the forests on the steep mountain slopes of virgin soil which until then had been well protected by a mantle of living and dead vegetation. Once again the soil was depleted of the vegetative cover beneath the trees, even the leaves and twigs from the coffee and shade trees being turned into the soil.

In addition to the clean cultivation, most of the hillsides were cut by drainage ditches having steep grades. The unabsorbed water from the tropical rains washed the loose cultivated soil and organic material into these ditches, which sped the erosion debris to the rivers. The large accumulations of silt found behind power and irrigation reservoirs are sad monuments to the washing away of clean-cultivated soils by heavy rains under tropical conditions. The evidence of soil loss is apparent also on the hills, where the buttress-like roots of trees and rock outcroppings become more prominent every year.

When Coffee Was King

Back of this early exploitation of the land was the demand from the European countries, particularly Spain, France, Italy, and Germany, for the mild mountain coffee of Puerto Rico. The records show that coffee became a Puerto Rican crop of importance as early as 1760. Ten years later, the export production was 700,000 pounds. The Spanish Government, aware of the rich possibilities of the industry, began a movement to improve the product and at the same time to promote its sale. In 1768, the King of Spain by royal decree exempted coffee growers from the payment of taxes or charges for a period of 5 years. Methods of cultivating the coffee plantations and processing the berries were studied, and recommendations were made which increased the production and improved the quality until Puerto Rican coffee became a standard by which other coffee was judged.

In the 30 years prior to the end of the eighteenth century the average export production was nearly a million pounds a year. By the end of the first half of the nineteenth century the production of high-quality coffee for export had reached 11 million pounds per annum. From 1850 to 1897 it was increased gradually to meet the demand of the European markets, the maximum production of 65,461,291 pounds being reached in the fiscal year of 1895–96. This figure includes an estimated 7½ million pounds of coffee used on the island. The total area in coffee that year was 197,031 acres, 41 percent of the total land under cultivation on the island, and the yield averaged 332 pounds an acre.

Coffee indeed was king all during the nineteenth century on the island. It constituted the main agricultural export crop and was the chief source of income for half the population. The owners of coffee farms were the elite of Puerto Rico. When production was high, they built new homes, planted more

A rejuvenated coffee tree growing from the 5-inch stump of an old tree. Three main shoots have been left to become the productive branches of the new tree. An individual terrace has been built around the tree which will conserve fertilizers, organic matter, moisture, and soil.

Mr. Telford is Soil Conservationist, In Charge of Observational Studies, Mayaguez, Puerto Rico.

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coffee trees, and made payments to their creditors. In poor years, they made only interest payments, as bankers were quick to furnish all necessary expenses against the next crop. This easy credit resulted in heavily mortgaged farms.

Then the devastating hurricane of 1899 reduced most coffee owners to poverty through the loss of that year's crop and the three following. Since that time it has been difficult to obtain sufficient credit to keep the farms well managed. After establishment of the American sovereignty in Puerto Rico in 1898, the European market was lost. Not until 1915 did Puerto Rican planters recover sufficiently from the double calamities of loss of market and the hurricane to export more than 51 million pounds of coffee.

Although coffee exports from Puerto Rico have been decreasing steadily since 1915 for various reasons, until 1928 the value of coffee exported averaged more than $5,000,000 annually. In the fall of 1928, another disastrous hurricane visited Puerto Rico. It did not cause as much damage as the one of 1899, but part of the crop was destroyed and considerable damage was done to the trees, especially on the plantations situated on the northern slopes of the mountains. Between the years of 1928 and 1932, production was low, and another hurricane in 1932 kept production low for 3 more years. From 1928 to 1944, the average annual production equaled only the coffee consumption of the island, estimated at 14,000,000 pounds annually for that period, although some coffee was exported between 1929 and 1940.

A 10-year-old coffee tree at Mayaguez demonstration farm ready to be harvested.

Soil Conservation Principles

In 1939 the Soil Conservation Service began its work in Puerto Rico. Seeking to determine annual soil losses taking place in coffee plantations, it established at Mayaguez, in October of that year, runoff plots with catchment tanks. These coffee plots were located on granular Mucara clay soil having an average slope of 60 percent. In one plot the natural slope was maintained and the soil was cultivated as usual. In the other, terraces were built for the individual trees, and the ground cover was left. The soil loss from the area which has been kept free of ground vegetation or mulch and is not terraced has consistently been greater than from the area where the mulch is allowed to accumulate on the individual terraces. The greatest soil losses on these plots occurred in 1944. The unmulched and unterraced plot lost soil at the rate of 30 tons to the acre, about ¼ inch of topsoil, whereas the mulched and terraced plot lost less than 2 tons of soil an acre. As the coffee trees have not yet come into production, however, yield figures are still not available.

The material which can be used for mulch, or ground cover, may consist of grasses, ferns, *cohitre morado* (*Callisia monandra*, Sw.), or other low-growing plants which will grow in the shade. On poor soils where the density of the shade exceeds 50 percent, living plants do not make a suitable ground cover. Under these conditions, an applied mulch of organic material is useful in preventing excessive erosion while the shade is being corrected and living ground cover becoming established. Careful observational studies conducted by the Insular Experiment Station and the Extension Service have shown that coffee trees to be productive require decaying organic material. Most of the plants which contribute to the ground cover are of short life and seldom grow more than 2 feet tall. It is not difficult or expensive to remove the vines and shrubs of an aggressive habit with a machete once a year and leave the rest to form a duff, or cover of partly decayed vegetable matter. Present observations indicate that the prevention of soil and fertilizer losses by mats of growing plants is far more beneficial to the coffee trees than was the initial system of clean cultivation.

Most coffee is grown on hillsides with slopes of from 10 to 70 percent, and in localities where the annual rainfall is more than 70 inches. Under these conditions the Soil Conservation Service in cooperation with other agricultural agencies developed the

individual terrace system for the conservation of soil, moisture, and fertilizer. The individual terrace, as known in Puerto Rico, is a small bench terrace large enough to accommodate a single tree. The dimensions of an individual terrace depend upon the slope and the size of the tree for which it is built. Generally speaking, the bench should have an area corresponding to the vertical shade cast by the crown of the tree. The minimum terrace for effective use in coffee should have a bench area of approximately 28 square feet, which would be about the area of a circle of 3-foot radius. One-half of this area would be in cut and the other half in fill. The terrace bench should slope back about 4 inches from the toe to the heel, so that the excess water can be directed from the terrace edge to firm vegetated soil. The terraces are useful in the application of fertilizer, in the collection of organic material, in checking the velocity of the run-off water, in increasing absorption of water, and in furnishing a place for coffee workers to stand while harvesting or pruning the trees.

In the coffee regions of Puerto Rico, an average workman can build 20 or more terraces of adequate size in 8 hours. When old coffee trees are being rejuvenated, the spacing is usually so irregular that the number of terraces required may range from 300 to 600 on an acre. It has been shown that an old plantation of coffee thinned to 600 trees an acre will produce more coffee of better quality than an area of equal size on which the trees are crowded.

In preparing land for a new planting, the terraces are made at regular intervals of 12 feet each way. If it is desirable to rejuvenate an old coffee plantation by the inclusion of conservation practices, the old, broken, and closely set trees should be eliminated and individual terraces constructed only around those having the correct spacing of approximately 12 feet.

Extensive studies on the root systems of coffee show that more than 90 percent of the coffee roots are in the top 12 inches of soil. Therefore, chemical fertilizer applied to the surface of these terraces and covered with a layer of leaf mulch soon becomes available to the thousands of fine roots. When fertilizer is applied to steep slopes where terraces and mulch are not used, much of it is washed away.

Results of Conservation Experiments

The Agricultural Experiment Station of the University of Puerto Rico has been conducting an experiment in coffee yields for 11 years. On these plots economically sound agricultural practices have been used and the average yield per acre has been 668 pounds of dry coffee beans, in contrast to the island average of 104 pounds for the same period.

A survey of growers who kept records in the vicinity of Utuado, Maricao, Yauco, and Mayaguez disclosed that they were obtaining from 400 to 2,000 pounds of dry coffee beans an acre from observational areas where the individual terraces, mulches, fertilizer, thinning, and elimination of disease and excess shade had been intelligently maintained for several years. On five large farms, each having 30 acres or over in improved coffee, the average yields were more than 400 pounds an acre in 1944. These five farmers, all of whom have shown a profit from well-managed productive coffee trees, are: José Romaguera, Jr., Mayaguez; Miguel Alemany, Maricao; Juan Adrover, Yauco; Guillermo Látimer, Adjuntas; Andrés Cámara, Mayaguez.

The results from the run-off plots in Mayaguez during a period of three years (1941–43) indicate that areas in coffee which have been protected by individual terraces, crop residues, and good ground cover, lose less soil and moisture on steep slopes than do plots of sugarcane, of clean-tilled crops, or of Bermuda grass.

In view of these conservation facts and the possible economic returns of good coffee, the agents of the Extension Service and the technicians of the Soil Conservation Service have been able to interest many farmers in improving their coffee.

This coffee tree grows on an individual bench terrace in a rainfall run-off test plot. The run-off studies indicate that areas in coffee which have been protected by individual terraces, crop residues, and a good ground cover lose less soil and moisture on steep slopes than do plots planted in sugarcane, clean-tilled crops, or Bermuda grass.

Courtesy of Carlos Schaeffler.

Citronella distillery on Finca Xulá, Department of Retalhuleu, Guatemala. Citronella plants are growing in the foreground.

Grass Oil from Guatemala

Soaps and perfumes for Milady and some of the lotions to keep off mosquitoes and other insects contain essential oils. Guatemalan farmers are growing nearly 5,000 acres of citronella and lemongrass to produce oil for this demand.

by GRAHAM S. QUATE

The production of volatile oils from highly scented grasses has in recent years become a part of Guatemala's agricultural economy. Each year a third of a million pounds of this valuable product are exported from the country. This agricultural industry, relatively new to the Americas, has been one answer to the local farmer's need for an original cash crop in addition to coffee, which is the main source of income for Guatemala. In the Republic of Guatemala the sale of essential oil from citronella and lemongrass has provided means for the reclaiming of a number of insolvent or abandoned plantations. It has given employment to hundreds of farm families at better-than-average wages, and it has become a new source of foreign exchange. Recent wartime profits have been high. Now the enterprising group who established the industry at considerable risk are reinvesting their earnings, plowing this new cash back into the land in an effort to improve production methods and reduce costs to a point where they may successfully compete with the Far-Eastern producers who previously had exclusive control of this interesting agricultural pursuit.

Citronella and Lemongrass

Citronella (*Cymbopogon nardus*) and lemongrass (*C. citratus*) are closely related and similar in appearance and both yield a light-colored volatile oil with a pleasantly fresh odor. This oil is used in the soap and perfumery industries, for the scenting of insecticides, and for other technical purposes. From the farmer's point of view each grass has its advantages.

The dried grass is loaded on oxcarts for removal from the fields. This picture was taken on Finca Los Angeles, Department of Escuintla, Guatemala.

Lemongrass is more easily distilled than citronella and is somewhat the hardier, being less susceptible to damage by abnormally wet weather or by insects. Citronella has the disadvantage of being somewhat shallow rooted and is thus easily disturbed, especially when young. This peculiarity poses a special problem for those farmers who are contemplating the development of mechanical harvesters.

With respect to prices, lemongrass oil was formerly the more valuable, but since 1943 citronella oil has been the buyer's favorite. During late 1945, Guatemalan plantations were producing about 60 percent citronella and 40 percent lemongrass.

These grasses have been fairly well known in Guatemala for many years, being grown as ornamentals and occasionally as erosion-control strip crops, a purpose for which they are well adapted since neither is palatable to livestock. Citronella flowers in the months of November and December but fails to produce viable seed; lemongrass refuses to make even this feeble gesture.

Guatemalan growers believe that oil grasses must be carefully spaced and aligned to facilitate cultivation and harvesting and that weeds must be kept out in order to preserve the purity of the scented oil. In these beautifully kept fields the lemongrass is recognizable by its light color and by its erect slender leaves. Citronella leaves are broad and dark green, and when nearing maturity they droop in graceful curves. After cutting, the lemongrass stubble is denser and in making new growth it spreads out on all sides. Citronella stubble has fewer and coarser stalks, with new growth crowding upon the old.

Mr. Quate is Agricultural Attaché, Foreign Service Auxiliary, Department of State, stationed at Guatemala City, Guatemala.

Story of the Industry

Lemongrass and citronella were grown in Guatemala almost 50 years before they came to be important crops. The first plantings of citronella were made by Señor Julio Samayoa, who imported a few rootstocks near the end of the nineteenth century. Some types of lemongrass are native to the country; how the commercial varieties were secured is not known. A small quantity of essential oil was produced from these grasses during World War I, but this effort proved unprofitable and was soon abandoned.

During the early 1930's some of the Samayoa properties came into the hands of men who determined to attempt the production of grass oil. They could not foresee the long years of price depression to follow. By the end of 1941, with nearly 3,000 acres of citronella and lemongrass in production, the oil-grass pioneers were seriously close to financial disaster, when a sudden jump in prices saved the day.

With favorable prices, which eventually rose to five or six times the prewar averages, the infant industry secured a firmer hold on life, old debts were liquidated and the growers given a badly needed breathing spell in which to prepare for the strenuous days of postwar competition. By the end of 1945 oil-grass acreage had been increased to about 4,500 acres, and most of the 27 retorts on 9 plantations were operating around the clock with all production facilities stretched to the limit. An increasing volume of the sweet-smelling grass rolled in from broad well-kept fields which, had it not been for the enterprise of a few practical visionaries, would still be covered with worthless jungle growths.

New plantings of citronella at the beginning of the dry season are watered by irrigation.

Guatemalan citronella fields are broad, regular, and clean.

Escuintla and Retalhuleu

The lemongrass and citronella farms of Guatemala are, almost entirely, grouped in two localities. The older and larger group is in the Department of Escuintla, close to a branch railroad running south to the Pacific port of San José. The other group is located in Retalhuleu, some 100 miles to the northwest. Small shipments come from one other source, an experimental farm operated at Tiquisate by the *Compañía Agrícola*, a subsidiary of United Fruit Company. Although all of these farms are near the Pacific coast, the essential oil is shipped across the Continental Divide to the Atlantic port of Barrios and thence to the dealers in New York City.

This concentration in two localities is due in part to the fertile and level lands and to the climatic advantages of Escuintla and Retalhuleu. The prime factor, however, is the influence exerted by the two principal growers—Minor Keilhauer, owner of Finca Los Cerritos and a pioneer oil-grass grower in the Escuintla region, and Carlos Schaeffler, father of the industry in Retalhuleu.

Each of these localities has its advantages and disadvantages. At Escuintla the available tracts of level land are larger and more regular in shape, but rainfall is scanty during 5 or 6 months of the year, and irrigation is then necessary to maintain maximum production. At Retalhuleu the fields are smaller and more irregular as to boundaries and slope, but rainfall is abundant and well distributed throughout the year.

Harvesting and Replanting

Oil grass is harvested by hand. The cut stems are left as they fall for one or more days, since a proper amount of drying reduces the volume of foliage to be handled without affecting the yield of oil.

When ready for hauling, the grass is gathered into loose bundles, bound with spliced strands of the same plant, and loaded upon oxcarts. If the still is nearby, the oxcart delivers its load there; if the distance is great, tractor-drawn trailers or trucks pick up the grass at convenient points.

Cutting appears not to retard the growth of the grass one whit, new and clipped stems springing afresh from the stubble at the rate of a half inch a day. In 90 days a new crop is ready. After 10 or 12 cuttings the grass begins to lose its ability to produce a satisfactory quantity of oil, and the field is dug up, left in fallow for a while, or planted to a soil-building crop. In due time it is replanted to citronella or lemongrass.

Planting stock is secured from old uprooted clumps, each clump being separated into a dozen or so mats, which are set out in new fields or *plantillos*. New lands are not plowed but are kept clean by hand-hoeing until the new plants are well rooted. Thereafter, cultivation is by animal or tractor-drawn equipment. Plantings are usually made in May or June just before the rains start, or in November or December at the beginning of the dry season, when the plants are kept moist by irrigation.

Processing for Essential Oils

Essential oils are removed from citronella and lemongrass by a simple process of steam distillation. Most of the stills operating in Guatemala are located in old sugar factories which once produced panela, a crude brown sugar. Water wheels that once drove cane grinders now turn feed cutters to chop the grass into bits. Boilers once used to power sugar-mill engines now provide steam for cooking tanks.

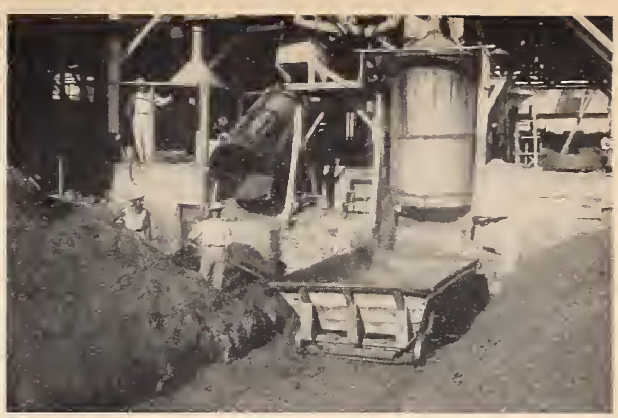
Citronella is distinguished by its broad leaf and drooping foliage.

The retorts are of various sizes, the larger ones capable of holding a ton or more of chopped grass, others holding less than 1,000 pounds. After being filled with chopped grass, the tanks are covered with a lid having a vertical band on its outer lower edge which sits in a trough of water running around the top of the tank. This forms a light water seal to prevent the escape of oil-laden steam. Steam at low pressure is introduced into the bottom of the tank, passes upward through the grass, and is carried away by a pipe near the top of the tank and thence into a condenser, from which a mixture of oil and water drips into a small receiver. Citronella is cooked in this manner for about 3 hours; lemongrass is exhausted in less time.

The cooking tanks are provided with swinging mounts so that they may be tipped for emptying. In most cases the steam pipe passes through the supporting axle and thence to the inside of the tank at the bottom so that it need not be disconnected at any time. When the tank load of chopped grass has been cooked to a point where oil extraction is no longer economical, the lid is lifted off, the tank is tipped over, and the exhausted grass, known as *bagazo*, dumped out.

A variety of individually designed condensers and receivers are used. Since the oil is light, it readily collects in a top layer, which is removed either by skimming or by a series of outlets on the side of the receiver. Because some water generally remains in the oil, the mixture is allowed to stand in smaller containers until the emulsion is entirely broken. The oil is then poured off, and the last remnants of moisture are removed by passing the liquid through a paper filter set in an ordinary funnel. The oil is now sparkling clear and ready to be placed in 50-gallon iron drums for shipment to the New York markets.

After lemongrass is cut it is tied in bundles.



The distillery retorts are mounted on swinging supports so they may be turned over for emptying.

Problems of the Industry

The theoretical possibility of four luxuriant crops each year of a grass which yields better than one half of 1 percent of its weight in oil worth more than a dollar a pound is an enticing prospect to any farmer. But the oil-grass grower has his special problems. Heavy rains make farm roads impassable, continuously operated machinery breaks down, malaria is prevalent, and froghoppers do damage to the grass. The plants suffer from excess moisture in the wet season, and during the remainder of the year expensive irrigation is necessary.

Citronella and lemongrass are heavy feeders, removing many of the valuable elements of the soil. Thus there is the problem of shifting fields, which get farther and farther away from the stationary distillation plants. Wood to fire the boilers day and night is no small item, for six truckloads are needed to fuel two retorts for 1 day's run. One grower who is unfortunate with respect to available wood supply has successfully used the exhausted grass as fuel, but the construction of stone drying floors and the continual handling of the refuse is an expensive process. The disposal of this *bagazo* is another problem.

One of the local oil-grass growers pretty well described the business when he said: "Yes, we do have our problems. Right now the spittle bugs are bad. But what we worry most about is pay rolls and prices. We do what we can to reduce costs, but if the market goes back to where it was before '41 we can't make 'a go' of it. The business pays at present, but we get this oil just one drop at a time, you know, and the stills must be kept going round the clock for 12 months in the year. It's what you might call a steady job."

A Tropical-Weed Killer

by DAVID G. WHITE
and AIDA G. VILLAFAÑE

Tropical weeds are costly to farmers because they decrease yields of economic crops and require considerable labor for control. Productive land has been abandoned, in many instances, because of persistent weed pests. Progress in combatting these weeds has recently advanced with the use, at the Federal Experiment Station in Puerto Rico, of synthetic hormones, which are sprayed on the weeds in very low concentrations.

Natural and Synthetic Hormones

Hormones occur naturally within plants, where they act as regulators of growth phenomena. For this reason the term "growth-regulating substance" is often used in place of the word hormone.

During the past few years many hormones have been chemically synthesized in the laboratory. These synthetic hormones induce the rooting of some plants and the fruiting of others when applied at extremely low concentrations, such as 10 parts in a million parts of a diluent. Fruit trees have been sprayed with hormones to prevent fruit-drop, and potatoes have been treated to hasten sprouting. In contrast, hormones have been used to reduce the initial set of fruit, to cause excess fruit to drop, and to delay the sprouting of potatoes. This versatility is accomplished by different hormones at various concentrations depending upon the effect desired.

A portion of these dayflowers (*Commelina longicaulis*) were dead 3 weeks after they were sprayed with 2,4–D. Plants in background were not sprayed.

Scientists have known for many years that some hormones are not always favorable to the development of a plant, particularly if the concentration is too high or the plant is exceptionally sensitive. While the usual herbicide kills only those parts of the plant contacted, certain hormones have an injurious effect on the life processes of the entire plant.

An unusually potent hormone called 2,4-dichlorophenoxyacetic acid (commonly known as 2,4-D) has been found particularly effective in killing weeds when applied in a spray solution. This hormone is a selective herbicide, because it does not adversely affect grasses and certain other plants when used at a concentration that kills many weeds.

The responses of different plants treated with 2,4-D are generally similar, although the time necessary for the hormone to cause a noticeable effect may differ. The leaves show curling and twisting within a few hours to several days after spraying. Roots sometimes become enlarged and split. Leaves become yellow, and finally the plant disintegrates.

How to Use 2,4–D

Earlier experimenters used 1 part of 2,4-D in 1,000 parts of water after first dissolving the hormone in a carrier known by the trade name of Carbowax. 2,4-D is practically insoluble in water alone. At least one chemical company, however, now offers the hormone in a mixed powdered form which dissolves easily in water.

This station has used a commercial mixture of 2,4–D successfully for killing numerous weeds common in Puerto Rico. All the results herein reported were obtained by using Dow Weed Killer No. 23 (Formula A–510) sprayed in a water solution with a 5-gallon knapsack sprayer. The leaves of heavy stands of weeds were well covered with spray at the rate of 5 gallons for 1,000 square feet. Concentrations were varied experimentally from ½ to 5 parts of the commercial product to 1,000 parts of water.

The authors are Plant Physiologist and Junior Agronomist, respectively, in cooperation with the Government of Puerto Rico, at the Federal Experiment Station, U. S. Department of Agriculture, Mayaguez, Puerto Rico.

It was evident that the lowest lethal concentration varied for different weeds. Furthermore, such variables as the age or stage of development of the weed and climatic conditions also complicated the choice of concentration. The use of commercial spreaders and stickers as used in orchard sprays has given a more thorough coverage with 2,4–D and consequently resulted in a more even kill. It is possible, however, that some spreaders and stickers might lessen the effectiveness of 2,4–D because of an undesirable chemical reaction between the two. More extensive experimentation needs to be done before the most economical mixtures of 2,4–D for the many tropical weeds can be safely recommended.

Results on Specific Weeds

NUTGRASS (*Cyperus rotundus* L.), known as *coquí* in Spanish, is not actually a grass but a member of the sedge family which has become a persistent pest throughout the Western Tropics, Subtropics, and the southern United States. It spreads from numerous underground tubers which require considerable hand labor for removal, and even this method gives only temporary control. Applications of 1 part commercial 2,4–D to 1,000 parts of water killed nutgrass within 1 month after spraying. More than one application is apparently necessary to eradicate heavy stands, especially when the soil has been cultivated recently and some buried "nuts" have not yet developed tops.

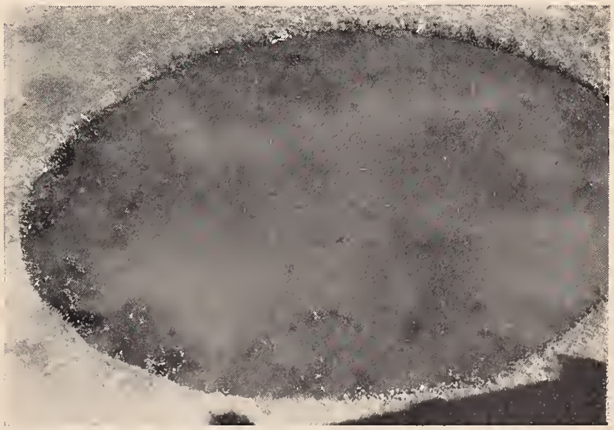
DAYFLOWER (*Commelina longicaulis* Jacq.) is *cohitre* in Spanish. Few farmers in the Tropics escape this vine-like weed which regenerates itself vegetatively from parts of the stem or root as well as by seed. It is responsible for reduced yields of economic crops such as sugarcane. Spraying with ½ of 1 part to 1,000 parts of water has brought this weed under complete control. One thorough application of 2,4-D eliminates the dayflower as a competitive plant.

CALADIUM (*Caladium* sp.) is known as *malanguilla* in Spanish. Many species of this plant are planted for the beauty of their variegated leaves, but one species with uniformly light-green leaves has caused a great deal of trouble because it occupies some of the richest, usually moist, lowland soils in this hemisphere. The weed reacts quickly to 2,4-D but appears to require more than one application for complete eradication. The foliage is, however, very susceptible to ½ of 1 part of commercial 2,4-D to 1,000 parts of water.

WATER HYACINTH (*Eichhornia crassipes* Solms.), the flower called *flor de agua* in Spanish, is a floating water-weed which has become a serious pest in Florida and Louisiana as well as in the Tropics. The plant has a bulbous stem composed of large air-cells which act as a buoy for the entire plant. Since the roots are not anchored, the plants float with moving water and tend to block drainage ditches and even large waterways. Expensive barge-like machines have been employed to clear channels through dense masses of the water hyacinth. Hormone 2,4-D appears to be a much less expensive and more effective method of eradication. Single applications of 2 parts of the commercial product to 1,000 parts of water resulted in a satisfactory kill.

ROYAL WATERLILY (*Victoria regia* Lindl.), *maiz de agua* in Spanish, has leaves 6 feet or more in diameter, growing so rapidly as to become a weed in certain places. The leaves and leaf stalks are spiny and, therefore, difficult to handle. The roots are usually

(*Continued on page 128*)



The picture on the left shows the large leaves and stems of the Royal waterlily (*Victoria regia*), which were badly curled 3 days after 2,4–D had been applied. The picture on the right shows the same pond 1 month later. The lily pads had completely decomposed.

ALONG THE *Agricultural Front*

▲ Brazil Develops Cashew Industry

As a result of development by outside interests and because of lack of competition from the East, impetus is being given to the development of the cashew-nut industry in Northeastern Brazil. Commercialization and exportation of the nut is on the increase in Baía, Pernambuco, Ceará, and other States. It is reported that a machine has been developed that shells the nuts without injuring them and at a lower cost than by the former method of hand shelling. A moderate industry is also developing in cashew-shell oil, some of which has been exported.

The cashew nut is native to the Northeast coast of Brazil and grows on practically any type of soil, and it thrives in the sand dunes of the open or semi-open country. The tree flowers in August or September, and the fruit ripens from November to February.

While most foreign countries appreciate the cashew for its nut, Latin Americans value it for its fruit, or apple, which is soft, juicy, acid, and highly astringent before maturity. The apple is eaten raw, and a refreshing beverage known as *cajuada* is made from it. Wine is manufactured commercially from it in Northern Brazil, and the fruit is preserved in various forms as an article of commerce.

▲ Extension Work Paying in Brazil

The USDA Extension Service training program for students from South and Central America has been going on for 3 years. The following excerpts from a letter written by "Jerry" 18 months after his return to Brazil as manager of a poultry and hog farm near Rio de Janeiro indicate the use and value of his training in food production. He received his extension training in poultry, hogs, and corn in Delaware and in Indiana.

"Things are coming along fine * * *. I'm really proud of everything I've been applying down here. Our broiler business is just fine * * *. We're selling better than 1,000 per week now. I want to tell you something: I have four brooder houses now (the long type), loaded with 2,000 chicks each. The percentages of all of them are as follows: 97, 97, 96, 97, 97! It's something! Of course I expect about 90 to 92 raised until the time they reach 14 weeks, but we used to raise broilers with 62 percent.

"Some time ago I * * * told you that I was sure that our chicks were dying with pullorum disease * * *. Finally we * * * did another pullorum test and culled out the hens the right way and since then our percentage in raising chicks has been coming up nicely.

"* * * the owner is giving the best of his efforts to get set a dressing and quick-freezing plant, so that we'll be able to hold * * * in storage all the available production of this region."

WEED KILLER

(*Continued from page 127*)

embedded in mud 5 feet or more below water, which makes complete removal and eradication of the plants almost impossible. However, a single application of 2 parts of commercial 2,4–D to 1,000 parts of water caused the death of all plants in a pond on the station grounds.

LOTUS LILIES (*Nymphaea* spp.) are known as *lotos* in Spanish. Various species of waterlilies of the day-blooming lotus type are also often troublesome in preventing thorough flushing of slow-moving water. Like the Royal waterlily, their roots grow in the bottoms of ponds or creeks and are difficult to remove. A single application of 2 parts of commercial 2,4–D to 1,000 parts of water eliminated two species in the station ponds.

Harmless to Some Plants

Applications of commercial 2,4–D on waterlilies have affected only the plants which were sprayed. Animal life in the ponds has also apparently progressed undisturbed. This is not surprising because the amount of 2,4–D mixed with the pond water after spraying was infinitesimal.

In using this hormone it has been our experience that tropical grasses in general are not adversely affected. The station lawns were sprayed with 1 part commercial 2,4–D to 1,000 parts of water by means of a 500-gallon orchard power sprayer. Many weeds in a newly sodded lawn of manila grass (*Zoysia matrella* (L.) Merr.) were eliminated in this way at small expense. Special caution is necessary while applying the chemical on lawns in order not to spray flowers and shrubbery. For example in our tests lower leaves of hibiscus which were accidentally sprayed turned yellow and dropped.

These are only a few of the possibilities for using 2,4–D in the control of tropical weeds. The reader is cautioned regarding the indiscriminate use of 2,4–D, for a great deal of experimentation is needed yet to establish fully the most effective uses of this hormone as a tropical-weed killer. Initial results, however, are promising.

THE RIO PANUCO BASIN—MEXICO

by JANE W. ROLLER

Tributaries of the Río Pánuco system in east-central Mexico rise in the Sierra Madre Oriental, the mountain chain which borders the central plateau on the Atlantic side. The drainage basin resembles a fan in shape with the handle pointing toward the Gulf of Mexico. Three of the chief tributaries—Río Verde, Río Moctezuma, and Río Santa María—after cutting deep gorges through unresistant strata of rock in the mountains, join to form the Pánuco, meandering some 350 miles east across the lowlands. A fourth river, the Tamesí, swings in from the north and enters the Pánuco through a series of salt-water lakes near Tampico. Seven miles to the east, at La Barra, the Río Pánuco system empties into the Gulf.

This drainage basin extends over approximately 30,000 square miles of diverse agricultural and oil-field country. Rivers of the system form, in part, the boundaries of the States Querétaro, Hidalgo, San Luis Potosí, Veracruz, and Tamaulipas, where their borders come together.

Climate and Vegetation

With a range of elevation from sea level to several thousand feet within a relatively few miles, the climate and soils are as varied as the configuration of the ground. Mountains to the west and north influence precipitation in the area. Rainfall varies from 80 to 100 inches annually in a strip of country southwest of Tampico, whereas it averages only 45 inches in that city. To the west the precipitation gradually diminishes, until in the highland country the annual fall is 30 inches or less. The Basin is classed generally as having a humid, subtropical climate through the lowland, but cooler and drier in the upland country. Part of the region is subject to frosts each year as far south as Tampico. Cold winds, spoken of as northers, sweep in from the Gulf of Mexico and the cold continental land mass to the north. Northers occur from September to March, and during the height of the windy season in November and December they blow in as often as 7 to 10 times a month.

Tropical forest vegetation is the natural cover in the wetter sections of the Pánuco Drainage Basin. Scrub and grassland occupy the uncultivated barrancas or steep hillsides. One writer describes other more-level parts of the country as reminiscent of the rolling, grass-covered Iowa prairies. Part of the land has been cleared for crops and orchards, and there are large pastureland areas. Heavy ainfall and suitable soils in the coastal and piedmont sections stimulate the growth of native and introduced grasses. Soils are predominantly heavy clays and alluvial deposits with sandy soils in the river bottomlands.

Cattle Industry

In the Huasteca region, where the States of Veracruz, Tamaulipas, San Luis Potosí, and Hidalgo come together, grasses grow more luxuriantly than in almost any other section of Mexico. Large numbers of cattle are supported there without the use of supplemental forage crops. Huasteca land is so prized for grazing that it sells for $10 an acre as compared

(*Continued on back cover*)

U S DEPARTMENT OF AGRICULTURE — NEG.727 OFFICE OF FOREIGN AGRICULTURAL RELATIONS

Reading about the AMERICAS

Brazil—Orchid of the Tropics, by Mulford and Racine Foster. 314 pp., illustrated with photographs, kodachromes, and sketches. The Jaques Cattell Press, Lancaster, Pennsylvania, 1945. Here is a book that takes the reader to Brazil, traveling with the Fosters on adventurous excursions through virgin jungle forests, malarial swamps, and on mountainsides in search of rare air plants. These enthusiastic naturalist-explorers visited, among many other places, the State Cacao Experiment Station at Agua Preta, a littoral fazenda on the seacoast, and the Polish Colony in Mato Grosso. From the "air gardens" of Brazil they brought back to Florida living specimens of many rare bromeliads, orchids, and cacti. The book is filled with vivid descriptions, humorous experiences, and botanical data.

The Story of Pacific Salmon, by Julie V. Crandall. 59 pp., illus. Binfords & Mort, Portland, Oregon, 1946. This is the story of salmon in the Pacific Ocean, particularly along the coast of California, Oregon, Washington, British Columbia, and Alaska. In simple language the author tells of the life cycle of Pacific salmon, the methods used to get the fish over the great dams in the Columbia River to spawn, salmon hatcheries and canneries, the need for conservation of the fish, and the place which salmon play in the food supply—canned, frozen, kippered, or salt salmon for human beings; fish meal for hogs, cattle, and poultry; and the oil as a substitute for cod-liver oil.

The Chemical Formulary, Volume VII, by H. Bennett (editor-in-chief). 474 pp. Chemical Publishing Co., Inc., New York, 1945. Many formulas are given for making, with simple equipment found in home or garage, such mixtures as weed killers for the garden and vegetable patch, insecticides, eosmetics, new flavors for food and drinks, soaps and cleaners, and numerous other aids to everyday life and better business. The formulas are the result of years of research and the scientific knowledge of industrial and research chemists. Directions are given clearly enough so that even those with little or no chemical knowledge or experience may create the mixtures. The formulas are cross-indexed, and lists of suppliers from whom ingredients may be purchased by mail are included.

A Thesaurus of Spanish Idioms and Everyday Language, by Lawrence K. Brown. 155 pp. The Marcel Rodd Co., Hollywood 28, Calif., 1945. This book is made up of lists of basic elementary and advanced idioms, humorous, colloquial and slang expressions, and proverbs in popular use throughout the entire Spanish-speaking world, with a classification of additional idioms and colloquialisms according to the Spanish-American country or countries in which they are current. A chapter on business idioms and phrases is included. Each idiom, expression, and phrase has its practical example and English translation, and two eonversion tables adapt many of these to the usage of different countries.

The Science and Art of Perfumery, by Edward Sagarin. 268 pp., illus. McGraw-Hill Book Company, Inc., New York, 1945. The author tells the story of perfumes and odors, including the scientific, commereial, and popular details of the industry, the history of perfumery, and the psychology of perfumes. Under such titles as "The Perfumes That Nature Created," "From the Petal to the Shelf," "The Perfumer's Zoo," and "Sticky Stuff, and Fragrant, Too" are discussed the processes that science and art have developed for obtaining the natural perfumes from the essential oils found in plants, the fixative qualities in various secretions from such animals as the civet cat, muskrat, and musk deer, and the qualities of the gums, resins, and balsams from trees, many of them found in Central and South America.

EDITOR'S NOTE.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

AGRICULTURE IN THE AMERICAS — O. R. CARRINGTON, EDITOR

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U. S. GOVERNMENT PRINTING OFFICE: 1946

Gifts of the Americas

THE PECAN

by J. W. PARK

Among tree nuts native to the Americas, the pecan leads in commercial importance by a wide margin. About 1 pound of pecans per person has been produced annually in the United States and Mexico in recent years.

The pecan is native to North America from the lower Mississippi Valley to Texas and Mexico. It is now produced chiefly in the southern United States from the Carolinas to Texas and Oklahoma, mostly south of the thirty-fifth parallel of latitude, and in northern and central Mexico. Experimental plantings have been made in a few other countries, but production is not of commercial importance.

The word pecan is said to be derived from an Indian word *peccan* or *puccan*. Authorities differ as to the proper pronunciation. Accent, according to good usage, is on the last syllable, which may be pronounced like the verb "can" or to rhyme with John. The latter is preferred by many.

The pecan tree is a species of hickory. It is long lived, and the native river-bottom trees attain great height and size. One tree in Louisiana is reported as measuring approximately 20 feet in circumference with a height of 107 feet and a spread of 135 feet. A yield as high as 3,000 pounds in one season has been claimed for it. Pecan nuts are of an attractive brownish color, with thin shells which in some varieties can be broken by pressing two nuts together in the hand. They vary widely in shape and size. A common size of seedling nut is about $\frac{11}{16}$ inch in diameter and $1\frac{1}{4}$ inches in length. A good-size pecan of a popular commercial variety is about 1 inch in diameter and about $1\frac{1}{2}$ inches long.

In Mexico the use of pecans in native *dulces* (candies) is well known. Candy similar to pralines is sold by street vendors in some areas. The bark of the pecan tree is said to be used in Mexico as a treatment for intermittent fevers and for dyspepsia.

One story is that Union soldiers returning North after the Civil War brought pecans with them and helped to spread the popularity of this fine nut. It was not, however, until after the turn of the present century that pecans became of considerable commercial importance.

From 55 to 60 percent of the entire pecan crop is produced on native or wild seedling trees, mostly in Texas, Oklahoma, Louisiana, and Mexico. These nuts are nearly all shelled commercially and marketed as kernels. The remainder of the crop is produced from so-called improved or named varieties. These have been selected because of desirable qualities and propagated by budding or grafting. A large part of the improved crop is grown east of the Mississippi River, southwestern Georgia being a recognized center of production and marketing. Pecan trees and nuts are subject to attack by various insects and disease, which must be combatted to obtain best yields and quality.

Over half of the so-called improved pecan crop is now marketed in the shell and the remainder shelled commercially. In preparing pecans for in-shell distribution, under good practice, they are cleaned, culled, polished, and sized by machinery. Supplementary hand work is, of course, necessary. Shipment is usually made in 50- or 100-pound sacks. In commercial shelling, machines are used to crack the pecans and, supplemented by hand work, to remove shell pieces and sort the kernels. In marketing, the kernels are sold either as halves or pieces and are generally packed in cartons of 30-, 50-, or 60-pound content. Small-size consumer packages are also used. The size of halves is designated by the number per pound and ranges from about 750 a pound for small kernels to 200 to 250 a pound for the largest.

Pecans are rich in food value, being especially high in fat content, which often approximates 70 percent of the kernel weight. The confectionery, baking, nut-salting, and ice-cream trades are important market outlets for pecan meats. Both in-shell and shelled pecans are popular for eating out of hand and for general home use.

The pecan is the latest of the important North American tree nuts in maturing. Harvest does not get under way in volume until early November.

Market distribution is made to all parts of the United States. Foreign trade in pecans is of minor importance although Canada has for years taken some shipments and, previous to the war, an effort was made to market pecans in Europe. The largest export year was 1938 when about 4,000,000 pounds in shell weight were shipped out of the United States. Imports into the United States from Mexico have in many years approximated a half million pounds.

In the 5 years, 1941–45, United States production of pecans averaged 120,000,000 pounds and had a farm value of $23,500,000. When the United States consumption of tree nuts of both domestic and foreign production is considered on a kernel weight basis for the 5-year period, pecans with about 45,000,000 pounds represent slightly over one-fourth of the total.

THE RIO PANUCO BASIN—MEXICO

(*Continued from page 129*)

with $2 to $4 in the dry, central part of the country. Huasteca land is also leased by the year for grazing. It often rents for the monthly rate of 30 cents a head, as compared with 10 or 20 cents in many other sections. Cattle are at present one of Mexico's chief export products. Animals from the southern and nearby States are fattened in the Huasteca region before they are sent to Mexico City for slaughter or are exported. Cattle raised in the northern part of the country, however, are brought directly into the United States after undergoing a rigid inspection.

Vegetables, Henequen, Fruits

Mexico produces many carloads of winter vegetables for United States tables. Most of the crops are produced in the west-coast States, but southern Tamaulipas has recently become the chief tomato-producing area on the east coast. Onions are produced extensively in the lowland areas near Tampico. This is one of the main onion sections of Mexico. In the fertile Río Verde Valley there are 60,000 to 80,000 acres of arable land planted to sugarcane, corn, and beans, together with many orange groves.

Henequen, the fiber plant, is an important crop in southern Tamaulipas even though only 5 percent of Mexico's total production comes from there. Mexico was one of the chief sources of hard fibers during the late war, and through its increased production of henequen the Pánuco Basin area rendered real assistance to the United Nations.

The Huasteca region is the second-most-important pineapple-producing area in Mexico. Mangoes are also one of the chief fruits harvested there, 10,500 tons being shipped out of the region in 1944. Veracruz and San Luis Potosí rank high in the production of oranges. Miles of groves are planted along the roads and railroads to facilitate the transportation of the fruit to centers of distribution. Although bananas have meant much to the Mexicans in the past as a cash crop, the industry today is of little consequence in the Pánuco Drainage Basin. The dreaded *sigatoka* disease has greatly diminished banana cultivation on a commercial scale in this region.

Limes are harvested from several plantings and from wild trees in the northern part of Veracruz. Limes are subject to frost and cannot be grown in areas where frosts are likely to occur. This restricts their production in part of the area. A fairly substantial lime-oil industry has been established in the Huasteca region. There are 5 small processing plants in east-central Mexico, where the undersized and imperfect fruit is utilized. Apples, peaches, and pears are produced in the States of Hidalgo and San Luis Potosí, but this area is not important for deciduous fruits.

Cities

Of the cities in the Pánuco Drainage Basin, Tampico is perhaps the oldest, busiest, richest, and most colorful. Early in the twentieth century it became a boom town when oil was discovered within 50 miles of it. Located on the north side of the Río Pánuco, Tampico became the largest oil center in the country and the second-most-important Gulf port. Even today, although many oil wells have run dry, thousands of gallons of petroleum enter Tampico's refineries through giant oil lines leading into the city from distant points. The bulk of the oil leaving Mexico and much of that for internal consumption is shipped from these huge refineries.

Although shipping and oil refining are the principal industries, Tampico's manufacturing plants produce an array of diverse commodities and articles such as carbonated water, flour, nails, soap, and sugar. There is a large electrical generating plant also that provides power for this important industrial center.

As a vacation spot, Tampico ranks high in the estimation of sportsmen and fishermen alike. Wildlife abounds in the wooded areas near the city.

El Mante, on the Pan American Highway, is in the center of the sugarcane country and, though only a small town, has Mexico's largest and most modern sugar mill. Both El Mante and Tampico are served by railroads and fine paved highways. Two branches of the National Railways of Mexico, as well as air service and steamship lines, bring raw materials into industrial Tampico, a city of 82,000.

The Río Pánuco is one of the lesser river systems in Mexico. None of its rivers is navigable commercially, and the region is not in one of the country's seven great population centers. However, the Pan American Highway, completed during the last decade, is an artery which is bringing new development into the community. Already the pulse beat has quickened, as produce moves along this paved highway to both domestic and foreign markets.

Agriculture in the Americas

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September 1946

NAMES & NEWS

P. K. Norris Visits Mexican Cotton Areas

P. K. Norris, Principal Marketing Specialist, OFAR, is visiting the major cotton-producing areas of Mexico in response to an invitation from the government of that country and a resolution of the Mexican-United States Commission. The general objective of this Commission is to promote the development of agriculture in Mexico and the United States along lines mutually advantageous to the two countries. It is expected that, following the survey of the Mexican cotton industry, recommendations as to future policy and procedure to be followed by the Mexican Government will be developed.

Skuli H. Rutford Visits Latin America

Skuli H. Rutford, Assistant State Director of the Minnesota Extension Service, left early this summer on a travel grant from the United States Department of State for an 18-week trip to Guatemala, El Salvador, Peru, Colombia, and Ecuador, where he is conferring with officials and technicians of those countries relative to various collaborative problems and the development of agricultural extension work.

James M. Watkins Returns to El Salvador

James M. Watkins has returned, with his family, to El Salvador after a period of triennial leave spent in the United States. Dr. Watkins is Agronomist at the Cooperative Agricultural Experiment Station in San Salvador.

Lee Hines in U. S. On Triennial Leave

Lee Hines, Director of the Ecuadoran Cooperative Experiment Station, is spending a few months in the United States on triennial leave. During his stay in this country Mr. Hines will make a trip to visit several State experiment stations.

Oscar Garibaldi P. Studies U. S. Extension Methods

Oscar Garibaldi P., Assistant Director of the Estación Agrícola de Tingo María, has spent the past year in the United States studying extension methods under a fellowship awarded by the United States Department of Agriculture. He spent some time in study at Michigan State College and also worked with USDA representatives in Washington. Señor Garibaldi is expecting to return to Peru early this fall and will visit a number of the cooperative agricultural experiment stations en route.

Berkley Accompanies Members of Abacá Mission

Earl E. Berkley, Senior Fiber Technologist, United States Bureau of Plant Industry, Soils, and Agricultural Engineering, has accompanied a mission of the Office of Defense Supplies of the Reconstruction Finance Corporation to Guatemala, Honduras, Costa Rica, and Panama. The purpose of the trip is to study the abacá plantations established in those countries in cooperation with the United Fruit Company and the Government of the United States. Special attention is being given to processing procedures and to different varieties of abacá.

Virgil C. Pettit Assigned To Experiment Stations

Virgil C. Pettit, Agricultural Engineer, OFAR, has been detailed to visit Colombia, Guatemala, El Salvador, Nicaragua, and Costa Rica, where he will assist with agricultural projects carried on under the Memoranda of Agreement between the governments of those countries and the United States. Mr. Pettit will give particular assistance in the building programs of the various experiment stations.

Fosberg Goes to Pacific Islands

F. Raymond Fosberg, Botanist, OFAR and BPISAE, left this spring for a botanical survey trip in the Pacific Islands. Dr. Fosberg was recently awarded a Guggenheim Fellowship to carry on additional research work with cinchona. He will continue this work in South America next February.

Agriculture IN THE *Americas*

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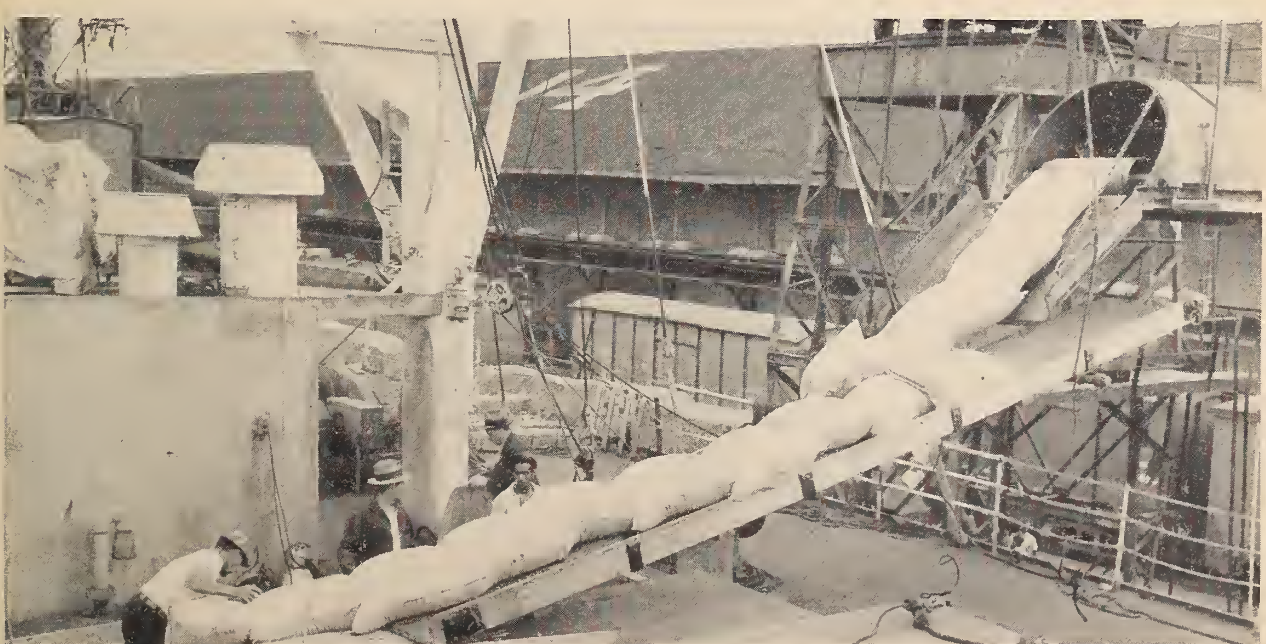
Food Possibilities In Latin America

Widespread hunger is part of the aftermath of world war. If the hungry millions are to be fed, we must all analyze our potential resources for supplying more food.

by KATHRYN H. WYLIE

During this time of hunger following the wartime demolition of agricultural land and equipment, the world is looking to the usual surplus-food-producing areas to relieve its suffering. One of these areas is Latin America, with its sugar, its grain, and its meat. Unfortunately, all of this vast and complicated region popularly known as Latin America is not a big bread basket, sugar bowl, and meat market with unlimited supplies waiting to be poured into the outstretched hands across the sea. It is divided into 20 countries, each different from the other, some producing more than enough food for their own people and some needing to buy food from others.

In order to break down this area for closer scrutiny,



Courtesy of Palmer Pictures

Coffee is one of the most important export products from Latin America.

let us cut it into two parts by an east-west line just south of the Equator. To the north we have a group of republics with varying agricultural conditions, some of which are almost self-sufficient in staple-food production, but some of which must import a variety of food products. To the south, the land very largely supports its own people and usually produces in addition considerable tonnages of excess grain and lesser amounts of meat.

Northern Area

Although this northern or tropical part of the Hemisphere must import large quantities of wheat flour, fats and oils, and rice, it sends abroad, largely to the United States, sugar, bananas, coffee, and cacao. Cuba is the largest sugar producer in the Western Hemisphere and is by far the largest world exporter of this important product. Before the war it exported 2.9 million short tons a year, or three times the shipment of Puerto Rico, its nearest competitor. Haiti and the Dominican Republic also produce export sugar, but in Mexico and Central America there is an increasing demand for sugar above domestic production. In addition to the Latin Republics, the British, French, and United States possessions produce export sugar. Honduras, Guatemala, Costa Rica, Panama, Colombia, Cuba, and Mexico have all been important exporters of bananas, the prewar shipment from these countries alone totaling almost 60 million 50-pound stems a year. This is also the producing region of mild coffee. Colombia leads in this production, but Central America, Mexico, Venezuela, and Haiti also produce and export a sizable quantity of this blending coffee. Cacao from Brazil, Venezuela, Ecuador, and Central America goes into chocolate bars and other food in the United States and elsewhere.

Banana-producing countries may send to world markets fruit equivalent to 50 million 50-pound stems.

Without a single exception, all the countries in this group import wheat or wheat flour, largely from the United States and Canada. Lard from the United States is vital, too, supplemented before the war by imports of copra from the Far East. As a whole, this area is a net importer of rice, Cuba being the most important, but Ecuador is producing an increasing surplus. Although many other products are vital to the economies of the countries concerned, either as imports or exports, the quantities involved are relatively insignificant in world totals.

Southern Area

Argentina stands above all other countries in surplus-food production in this southern or temperate belt of Latin America. There, when weather is favorable, the rich soil produces an abundance of corn and wheat and supports fat cattle and sheep. Chile, Peru, and southern Brazil are more or less self-sufficient in staple-food production. In fact Brazil sends out rice, beans, oils, and nuts, Chile ships beans and lentils, and Peru has an export of sugar. Southern Brazil, of course, is also the world's largest producer and exporter of coffee. Meat and meat products are exported from Uruguay, Paraguay, and Brazil in addition to Argentina. Even in this area, all but Chile and Argentina must depend on outside sources for varying amounts of wheat or wheat flour. A considerable part of Argentina's surplus goes to supply these needs. Before the war Argentina exported on the average 3.6 million tons of wheat, 5.6 million tons of corn, and almost 650,000 tons of beef and veal. Exports of oats, barley, and rye totaled another 730,000 tons, and pork, lamb, and mutton 75,000 tons.

Factors Affecting Present Food Supply

Into this usual or normal situation came the dislocations and stresses of a world at war. Far Eastern sources of supply for sugar, fats, and rice were cut

Kathryn H. Wylie is an Agricultural Economist, Latin American Division, Regional Investigations Branch, Office of Foreign Agricultural Relations.

Courtesy of John Phillips

Argentina has vast herds of beef cattle.

off, resulting in a search for increased supplies in the Western Hemisphere. Wheat and corn could not move in accustomed volume to previous markets in Europe, but the export demand for meat jumped sharply. Refrigerated shipping for banana cargo was cut drastically, and production declined. Along with the rest of the world, Latin America at first groped for solutions to its new problems and then girded itself to produce more of the deficit commodities and less of the surplus ones. Production rose and passed the prewar averages for many staple foods. Larger populations and expanded buying power, however, increased demand at home, so that exports did not reflect all of the gains in production. Large supplies of corn, wheat, and linseed in Argentina, coupled with lack of fuel, led that country to burn these grains as a substitute for coal and oil, thus cutting down materially the supply available for export.

Then in 1943 and again in 1945 drought swept Latin America from Mexico south to Argentina. The Argentine corn crop harvested in the spring of 1943 dropped to less than one-fourth that of the previous year. The sugar crop in Cuba in 1945 dropped off 18 percent from that of 1944. In fact, Cuba in 1945 suffered the worst drought it had had in 80 years. All over the northern area the dry weather was responsible for low yields of staple foods, making necessary more than the usual amount of imports in that year. In the southern area crop output was drastically curtailed and parched pastures provided little feed for the livestock. For most areas the drought was broken by the third quarter of 1945, and plantings for crops harvested in early 1946 were made without that handicap. Growing conditions in 1946 have been somewhat better than last year in some regions, but, because of the bad conditions then, stocks were low in January. As a result, this year's slightly larger harvests leave over-all food supplies still short. Wheat and corn production in Argentina was still far below prewar averages, largely because of reduced acreages.

Latin America As a Supplier in 1946

Even with reduced supplies, the Western Hemisphere Republics to the south of us are exporting to the deficit countries. World shortages are particularly acute for sugar, fats and oils, and grains. Of these, Latin America is a principal supplier of sugar, wheat, and corn. Cuba expects to export in the neighborhood of 4 million short tons of sugar in 1946, and Argentina alone probably will export nearly 2 million short tons of wheat and a little less than 2 million tons of corn. Brazil is expected to send abroad some corn, together with 150,000 to 200,000 tons of rice, and Ecuador has a surplus of 50,000 tons of rice. We must remember, of course, that these are not net surplus figures for the 20 Republics, since Cuba must import rice and many countries, especially in the northern area, import wheat and wheat flour. Although corn and wheat exports from Argentina are large, they are less than half the prewar total.

In addition to these vitally necessary foods, the banana-producing countries probably will send to waiting markets fruit equivalent to more than 50 million 50-pound stems. Chickpeas are being shipped from Mexico, and beans from Chile and Brazil. From 150,000 to 200,000 tons of cacao will come from

Rice is one of the world's staple food products. During the past few years the Dominican Republic has shifted from a net importer to an exporter of this crop.

Latin America, and more than 900,000 tons of meat. Winter vegetables and fresh fruit from Mexico and Cuba supplemented United States production during the winter months. With the exception of sugar, however, all of these exports fall below the prewar shipments. Importing countries are getting along with less of the scarce items so that in many places an already inadequate diet must be further reduced. Food contributions have been made to the United Nations Relief and Rehabilitation Administration from several of the smaller countries, and, although not large in terms of world need, they represent an effort to participate in the present food problem.

Throughout the whole northern area, where there is deficit or barely self-sufficient production of staple foods, a definite effort is being made to expand output, both by increasing acreages and by using improved methods of cultivation. During the past few years, for example, the Dominican Republic has shifted from a net importer to an exporter of rice. Harvests have also been increased in Central America and northern South America in spite of unfavorable weather. Plantings in many countries during 1946 are somewhat larger than those of last year. If growing conditions are friendly, Latin America is expected to produce larger crops in the coming year to help feed a hungry world.

Agricultural Missions to China and Philippines

Two agricultural missions, sponsored jointly by the United States Department of State and the United States Department of Agriculture and by representatives of each of the other two collaborating governments, left the United States early this summer for China and the Philippine Islands, where they will collaborate with agricultural scientists, educators, and government leaders. The missions were invited by authorities of both governments, and it is expected that they will make recommendations that will stimulate planning on a broad scale for national agricultural programs in both countries.

In addition to joint consultation with Philippine officials as to a Philippine National Agricultural Program and requirements for its implementation, the Philippine mission will advise immediate actions which might be taken on emergency problems, in order to restore the war-damaged agricultural economy of the Philippine Islands. This is regarded as a particularly acute problem in view of food needs and the necessity to restore the islands' production for trade. War and Japanese occupation of the Philippines greatly disrupted agricultural activities and decreased production of food and other crops. The islands are faced with a serious food shortage. Problems of agricultural rehabilitation and development of the agricultural economy of the Philippines are of paramount importance in assuring peace in that area of the world.

The Chinese and Americans composing the Chinese mission will suggest actions which might be taken on emergency problems. They will consult with the Chinese National Government on a national agricultural program and ways of bringing it into being. They will also recommend parts of the program as appropriate for collaboration by the two governments and indicate the projects, personnel, facilities, and organization necessary to carry out such collaboration.

Leland Everett Call, Dean of Agriculture and Director of the Agricultural Experiment Station, Kansas State College, is the United States head of the Philippine-United States Agricultural Mission, and Dr. Claude Burton Hutchison, Vice President of the University of California and Dean of the College of Agriculture, is the United States leader of the China-United States Agricultural Mission. Other United States personnel of the missions were selected, and the working program arranged, by the Office of Foreign Agricultural Relations, USDA, in collaboration with the United States State Department and the host government. The host governments have selected national personnel to fulfill the joint aspects of the missions.

Acacia Negra Industry In Rio Grande do Sul

Many farmers in Rio Grande do Sul are reaping good profits from black-wattle, secured from plantations of acacia negra trees. A tannin extracted from the bark is useful in tanning soft leathers, and the wood furnishes badly needed fuel.

by JOSEPH L. DOUGHERTY

Undulating slopes and low hills of east-central Rio Grande do Sul have taken on a new and different kind of vegetative cover in the last 20 years. This country, which has been tilled in crops since the first settlers came in 1740, is now being changed to forest land. The change is not complete, but a rapidly developing trend is evident.

The tree which is causing this change is known as *acacia negra* (*Acacia mollissima* or *A. decurrens mollis*), of the Mimosa family. Its popularity among Rio Grande do Sul farmers is due to the particular niche it fills in supplying the State's economic needs for fuel and tannin extract. Furthermore, farmers have found that much of their land which has been steadily declining in productivity for many years can be brought back to a relatively high state of fertility by growing this leguminous tree.

Most of the acacia production centers in the area 20 to 40 miles northwest of Porto Alegre in the municipalities of São Leopoldo, Novo Hamburgo, Cai, Montenegro, and Taquari. From the time of the first plantation in 1928, the planted area has increased so rapidly that it now covers nearly 50,000 acres, on which are growing more than 40,000,000 trees. An increase in the number of trees up to 200,000,000 is expected within the next few years, provided labor remains available.

With Quebracho and Eucalyptus Acacia Serves Many Purposes

Leather tanning ranks high in importance with the meat-packing industry in Rio Grande do Sul. There are 223 tanning plants of various sizes in the State, with 30 large tanneries in Novo Hamburgo alone. Two kinds of natural organic tannin are available. One is extracted from the bark of the acacia tree and is used in the preparation of soft leathers. The other is quebracho, which is extracted from the wood of the quebracho tree in Argentina and Paraguay and is imported in the solid form for use by tanneries in Rio Grande do Sul in the preparation of hard leathers. As a result of their special uses in the tanning process, acacia and quebracho extracts are more complementary than conflicting in their economic utility.

Courtesy of Rio Grande do Sul State Department of Agriculture

Stripping acacia bark prior to cutting the tree.

The wood of acacia is highly regarded as a fuel in Rio Grande do Sul and it supplements the fuel wood coming from the extensive eucalyptus plantations scattered over the State. Since the greater part of the land was originally covered with grassland called *campo*, similar to the pampas of Argentina and Uruguay, the supply of wood must come from plantations.

Fuel wood is essential for the factories, railroad engines, and boats. Although extensive deposits of coal exist in the municipality of São Jeronimo, near Porto Alegre and near Bage in the Fronteira section in the southern part of the State, the coal is so high in ash and foreign elements that it can be used only after special treatment and in special equipment built for that purpose. Railroad engines on the *Viaçao Ferrea*, the only rail line in the State, are especially constructed to burn coal and wood together. Wood is also used for cooking in practically every home in the State and for heating homes during the winter season in fire places and furnaces, as well as for construction.

Most of the acacia in Rio Grande do Sul is grown on red clay or sandy soils which have suffered from severe sheet erosion and soil depletion during the past 200 years since this section was first settled. While the tree is furnishing tannin and wood it is at the same time adding nitrogen and organic matter to build up the soil.

The Acacia Tree

Acacia negra appears to grow well in the vicinity of 30° south latitude. This line passes through the southern edge of Porto Alegre. The tree grows well at an altitude of 150 to 200 feet on rolling or undulating terrain, but it is found also in some higher areas such as Caxias do Sul, 80 miles north of Porto Alegre, at an altitude of 2,500 feet. At that altitude, however, there is the danger of frost damage, and an occasional heavy snow during the winter season causes considerable damage by breaking off limbs of the trees.

Although acacia seems to do well on poor soils, the amount of bark produced may be somewhat smaller than if grown on richer soils. The amount of tannin in the bark, however, seems to run from 25 to 35 percent for each kilo of dried bark whether the bark is produced on poor or rich soils.

At the age of 7 years, the tree produces from 3 to 5 kilos of dried bark, and 12 trees are required to produce 1 cubic meter of firewood. The cost of producing the tree up to that time is approximately 12 or 13 cents. Gross receipts from the bark and wood amount to around 21 cents, providing a net income of 8 to 8.5 cents for each tree. The natural growth period extends to approximately 10 years, but growth is so slow after the seventh year that to permit the tree to grow after that age is considered uneconomical.

Diseases and insects cause an average 20-percent loss in trees. Ants, termites, and borers appear to be the most damaging. The Saúva ant, which attacks the leaves, is fought constantly with arsenicals and carbon bisulfide.

Acacia Farm Owners

There are two classes of acacia farm owners in the State. One is the tanner or businessman, who generally owns in the neighborhood of 500 acres of land which he plants entirely to trees. The other is the *colono* or small-farm owner, who has perhaps 125 acres. Half of this may be devoted to the growing of acacia and the rest to corn, manioc, beans, other vegetables, and sugarcane as food for his family and livestock. A small amount of land, if any, is used for pasture.

Courtesy of Rio Grande do Sul State Department of Agriculture

The wood of acacia is highly regarded as a fuel in Rio Grande do Sul, and it supplements the fuel wood coming from extensive eucalyptus plantations scattered over the State. In the background are young acacia trees on typical ridge-like terrain.

Joseph L. Dougherty was formerly Agricultural Analyst, American Consulate, Porto Alegre, Brazil. Recently he has been transferred to Canada as Assistant Agricultural Attaché, American Embassy, Ottawa.

Courtesy of Rio Grande do Sul State Department of Agriculture

A 5-year-old stand of *acacia negra.* Most of the acacia production centers in the area 20 to 40 miles northwest of Porto Alegre. More than 40,000,000 trees grow in this area.

The tanner or businessman hires laborers directly or lets contracts for the production and harvesting of his acacia trees. He generally establishes his plantation one section at a time so that planting and harvesting may occur within the same year and continue from one year to the next. Thus contractors who have little or no capital may have an opportunity to establish a home for a number of years in one place, and available labor can be maintained throughout the year.

The *colono* lives on his own farm with his family and does the work of his own plantation. Although about half of his farm is devoted to acacia, he plants only from 5 to 12 acres each year. By planting and harvesting a few acres each year, his work and income are evenly distributed. Some *colonos* with large families, while operating their own acreage, are able at the same time to assume the responsibilities of a contractor or *capataz* for a larger acreage owned by a tanner or businessman. The *colonos* are generally descendants of early Italian or German settlers. They are accustomed to hard manual labor, and their work is done well.

Growing the Tree Requires Seven Years

Nearly all acacia-production operations except plowing are done by hand. Plowing is usually done with oxen. Practically no farm equipment is used other than plows and hoes, although harrows and cultivators could be used with this crop.

In preparing seed for germination, the common practice is to place it in a vessel into which boiling water is poured and allow it to stand until the water cools. This cracks the hard outer coat and the seeds are ready to germinate in plant beds. No window glass or other covering is used on the slightly raised plant-bed frames. Seeds are spaced about 2 inches apart. When the seedlings have reached the age of 3 to 6 months, they are removed for planting.

The field is plowed and harrowed sometime during April and May. Seedlings may be set out any time between May and November, though the usual time in Rio Grande do Sul is during the winter months of June, July, and August immediately following a rain. Plants are placed at 2-meter (a little over 2-yard) intervals, in rows the same distance apart. At this rate, 2,500 trees may be planted on each hectare, or about 1,012 on an acre.

During the first year corn, beans, or manioc are grown between the rows of seedlings, but the trees grow so rapidly—13 to 17 feet during the first year—that the shade created is too much for such crops by the second year. During the first year and a half two clean cultivations are made by hand hoeing.

When the contract has been let for the growing of the acacia crop, the living trees are counted at the age of a year and a half. The owner and the contractor make the count, and a financial settlement takes place. From this time until the trees are 7 years old practically no maintenance is required except for disease or insect control, for which labor may be hired.

Obtaining the Extract

The tree is harvested at about 7 years of age. The bark is stripped from the lower part of the tree and then the tree is felled. Next, the bark is removed from the upper part of the fallen trunk and the tree and bark are cut in meter lengths. The bark is thoroughly dried and assembled in bales of 75 to 80 kilos, when it is ready for transportation.

Acacia bark may be sold directly to tanneries in the form of baled bark, as *moida*, or as bark powder, or the dried bark may go first to commercial bark processors, where it is made into *moida* and then sold. This is ground or shredded bark, produced by running it through a hammermill. Some processors have additional equipment which in the process of obtaining *moida* separates a byproduct known as bark powder.

Continued on page 147

Amilcar Savassi, Founder Of Barbacena's Sericulture

Successful production of silk is a comparatively new industry for Brazil. The man who believed the silkworm could thrive in Brazil was an Italian, and he began his work in Barbacena, high in the mountains of Minas Gerais. The writer visited him there and learned of his work.

by SHIRLEY M. TEWELL

Lodged high in the foothills of the southeastern Minas Gerais mountains is the city of Barbacena, birthplace and center of Brazil's vast silk industry. Although today that country's largest silk-producing area is in the State of São Paulo, the silk plant at Barbacena, known as *Inspetoria Regional de Sericicultura*, retains for itself due importance as the push that sent the ball rolling.

The man behind the push is small, energetic Amilcar Savassi. Talking with him, one becomes aware that here is a man whose life interest has been centered in the production of silk, as closely as is the chrysalis within the cocoon. All his resources of energy, initiative, determination, and foresight have been directed toward one focal point, the propagandizing of silk production in Brazil.

In 1889 Amilcar Savassi, a stocky, dark-headed Italian boy, arrived in Brazil with his parents and settled in an Italian colony in Minas Gerais called *Colonia Rodrigo Silva*. Being a native of Italy and well acquainted with the silk industry there in which his father had worked, the lad early recognized the unlimited opportunities that Brazil offered as a silk-producing country. From the time he was a young man, he made it his purpose to interest the Federal, State, and Municipal Governments, as well as the people, in this industry. He was sure that silk production, a subsidiary or secondary industry at first, would soon take an important part in the economy of Brazil. His determination to awaken Brazil to the advantages of the industry was not dampened by discouragements, failures, and financial problems.

To equip himself more thoroughly for his task, he returned to Italy in 1905 for a year. There he studied and did research work connected with the silkworm. After his return, the Brazilian Government passed laws to facilitate the installation of silk plants in the

The author was until recently a member of the staff of the American Embassy, in Rio de Janeiro, Brazil. At present she is employed by the United States Department of Agriculture in Washington.

The author and Amilcar Savassi in the garden of the latter's home in Barbacena.

Main building at Barbacena's sericulture station. Although the plant is not large, the layout and equipment are complete, and one can watch the process in action from the laying of the eggs by the moths to the time when the finished silk is run off in bolts in the factory.

country, and in 1912 the Sericulture Station of Barbacena was founded, under his supervision.

Brazilian Climate Suitable For Raising Silkworms

His first experiments with silkworms convinced Mr. Savassi that 50 percent more silk could be produced in the State of Minas Gerais than could be produced in Italy in the same length of time. The warm, humid climate of Brazil stimulates the silkworm to a higher rate of propagation. This same warmth and humidity together with a desirable soil type, keeps mulberry trees, the sole source of nourishment for the silkworm, thick with succulent leaves from September to May. Whereas in Italy the normal cycle of the silkworm could be completed only semiannually, with an abundant harvest in the spring and a smaller one in the autumn, it was discovered that four to five cycles a year could be completed in the high altitude and damp climate of Minas Gerais. Further experiments proved that in Amazonas a silkworm cycle could be completed twelve times a year and that in the Manaus region only 26 days were required.

How great, then, were the unexploited resources for silk production which Brazil could offer, not for the asking, but as the result of concentrated effort and organization. The people must be shown how to procure, feed, and care for this previously untouched source of wealth, the unimposing silkworm.

This Amilcar Savassi set out to do. The silk plant in Barbacena remained his headquarters, but he traveled throughout Brazil, educating the people in sericulture procedures. Brazilians were quick to recognize their opportunity, and they had much in their favor in realizing it—climate, soil, excellent instruction, and Government backing and encouragement for the enterprise.

When, in 1932, Mr. Savassi was promoted to Chief Inspector of the sericulture plant in Barbacena, he could look with satisfaction at this pioneer plant and the industry which had been built up largely through his industrious application and enthusiasm for his work.

Barbacena a Training School

The silk plant at Barbacena is not, and never has been, a station for the large-scale production of silk for either domestic or foreign consumption. What little silk is produced there is sold locally. It is mainly an establishment for the training of young men and women in the industry. For this reason the plant is not large, but the equipment and the layout are complete, and one can watch the process in action from the laying of the eggs by the moths to the time when the finished silk is run off in bolts in the factory.

Three training courses are offered each year at the *Inspetoria Regional de Sericicultura* entirely at government expense. Each course lasts for 45 days, two classes being held each day. The trainees are instructed in each separate step of the process of silk production, from the laying of the eggs, through the hatching and growth of the thread-like worms and spinning of the cocoons, to the factory process of removing the strands of silk, winding it onto spools, and weaving it into cloth. The training is not confined to book learning but is interspersed with practical experience in the actual care of the worms. Special courses are required in the care of the mulberry trees. Since their leaves constitute the entire diet of the silkworms, these trees form an inextricable part of the sericulture industry.

Anyone observing the processes of silk production

Mulberry orchard at the sericulture station.

for the first time is especially impressed with the prodigious number of cocoons that go into the making of one silk stocking. It takes an average of 7 cocoons to make one strand of silk thread, and 600 cocoons, weighing 1 kilo (a little over 2 pounds), to give 100 grams of thread. As this is the amount needed to make 2 meters of fine silk material or one pair of silk hose, one realizes the almost astronomical numbers of cocoons necessary to satisfy woman's eternal demand for silk goods.

The instruction given these novice silk growers must be accurate and extensive, for these young men and women will carry their knowledge of scientific sericulture to ever-expanding new areas. The founder of the Barbacena station is gratified to see the waiting lists of hundreds of young people anxious to enroll in the training program.

Silk Industry Flourishing in Brazil

From the time Brazil recognized the pecuniary advantages of silk as an item of trade and its production as an aid in the country's desire to become an industrial nation, the Federal Government has stimulated an interest in sericulture by financing and supervising the installation of silk plants. Amilcar Savassi was the first man sent out by the Ministry of Agriculture to encourage silk production as a subsidiary agricultural industry. He and many men like him spent years of concentrated effort in making the people of Brazil silk minded. The fruits of those labors are ripe today, and Brazil now has silk plants in every State, from Amazonas to Rio Grande do Sul.

In the State of São Paulo alone, which produces 95 percent of Brazil's silk, last season's crop of silkworms yielded 11,000,000 pounds of cocoons, valued at 4,500,000 United States dollars. Although this is an above-average crop so far, even larger ones are planned for the future if prices remain favorable and export markets are available. Today Brazil is one of the four countries heading the list of silk producers. During the war, when Japan, China, and Italy were unable to produce silk, Brazil stepped in and attempted to fill the large demand from Argentina and the United States.

With the objective of rendering more efficient technical help to the centers of silk production, the Government recently created three new positions in the Ministry of Agriculture, the titles of which will be Sericulture Technicians. These men are to stimulate production of silk by advice and aid to producers.

One of the three men appointed is Barbacena's Mario Thome da Silva. Carrying on the founder's work, he will continue to spread information and give aid to beginning silk growers. Like their first Italian teacher, these growers believe that here is an industry which will yield large financial returns and manifold contributions to the industrialization of Brazil.

When the female moths are ready to lay eggs, they are placed in individual cloth containers, which are strung together and hung from a beam in the ceiling.

This 2-year-old Manila-grass lawn at the Puerto Rican Experiment Station has withstood one severe drought

An Ideal Tropical Lawn Grass

In the Tropics, a grass that is especially adapted to withstanding hot dry weather is essential for smooth green lawns. The Federal Experiment Station in Puerto Rico has been experimenting with lawn grasses and believes it has found the best one for that climate.

by NORMAN F. CHILDERS

By far the best lawn grass grown at the Federal Experiment Station is Manila grass, or *Zoysia matrella* (L.) Merr. It has proved itself definitely superior to such lawn grasses as Centipede, St. Augustine, Bermuda, Java, and Carpet. It is chiefly a tropical and subtropical grass, although it is being grown successfully in the temperate climate of the United States as far north as Connecticut. The numerous dark-green blades are tough, short, narrow, and pointed.

Norman F. Childers is Assistant Director of the Federal Experiment Station, Mayaguez, Puerto Rico.

The chief merits of Manila grass are that it remains green during hot dry weather, crowds out most weeds and other grasses, and appears to have no important insects or diseases. The grass will withstand more shade and competition with other plants, such as bamboo, than any of the grasses listed above. The flower stalks appear between November and April in Puerto Rico, but being short they are not particularly objectionable and can be cut with a rotary lawn mower.

Well-established Manila grass which has been properly weeded and fertilized forms a thick mat that feels like a Persian rug underfoot. The sod will endure considerable punishment from wheel or foot wear, and for this reason it serves well on playgrounds, roadways, golf tees, fairways, cemeteries, and on fields used for football, drilling, or airplane run-

ways. Unfortunately this toughness makes the grass difficult to cut with a hand lawn mower, but a rotary power mower cuts it easily.

Propagation

Propagation is done entirely by sod blocks or sprigs. Two-inch-square sod blocks set about 6 to 8 inches apart will coalesce to form a continuous sod within about 9 months with proper fertilization, watering, and weeding. The blocks can be transplanted with a high survival when the usual precautions are taken. Although no cost figures are available for comparison with other grasses, it has been observed at this station that Manila-grass lawns, once established, are economical to maintain because of relatively less need for weeding and mowing.

Manila grass grows on a wide range of soils from sandy coastal types to the heavy adobe clays, the latter of which is characteristic of the station grounds. The grass seems to grow best at a pH between 5.0 to 6.0. In alkaline soil Manila grass grows poorly, and ordinary Bermuda grass may give it considerable competition.

In planting Manila grass it is well to plow or spade the upper few inches of soil and shift the soil where necessary to obtain a smooth surface with good top drainage. A wheelbarrow of rotted leaves or rotted manure for each 100 square feet of lawn, mixed with the upper 2 to 3 inches of soil, will encourage more vigorous growth and quicker coverage. A complete fertilizer high in nitrogen, such as 10–10–5, at the rate of 4 pounds to 100 square feet should also be mixed with the upper layer of soil. A nitrogen fertilizer, such as sodium nitrate, ammonium sulphate, or ammonium nitrate, at the rate of 0.5 pound per hundred square feet is usually all that is needed for heavy or loamy soils.

The blades of Manila grass are short, tough, narrow, pointed, and dark green. Because seed germination is poor, propagation is entirely by clumps.

The sod blocks an inch and a half or 2 inches square can be set 6 to 12 inches or farther apart, depending upon the amount of propagation material available. If they are set 12 inches apart in the Tropics, with proper subsequent management they should form a continuous sod within about 18 months; those spaced 6 inches apart require only about 9 to 12 months. The lawn should be watered thoroughly after planting if there are no rains. The best time for planting is at the beginning of the rainy season.

Although *Zoysia matrella* fruits heavily in Puerto Rico between November and April, seed germination under lawn conditions is so low that establishment of a lawn by seeding is impractical. One of the present problems at this station is an attempt to improve seed germination of Manila grass in order to speed up and simplify the establishment of Manila-grass lawns.

Care of Manila-Grass Lawns

Although Manila grass requires considerably less attention than other tropical lawn grasses, it must be mowed and fertilized regularly in order to maintain vigor and beauty. At this station during the past winter season Manila grass was mowed once while Carpet grass was being cut five or six times. This ratio during the rainy season is usually less, or about one to three. A power rotary lawn mower cuts Manila grass easily, but with a hand lawn mower it must be mowed when the grass has grown not more than three-quarters of an inch since the last cutting; otherwise, the cutting is difficult. Manila grass which is receiving adequate nitrogen and water is easier to cut than grass low in these constituents. In order to maintain vigor and a thick carpet effect, the grass must be cut with the cutter bar set an inch and a half to 2 inches above the ground.

Until Manila grass is well established, it must be weeded thoroughly at least once a year or perhaps twice if rains are regular. The hormone spray 2,4-dichlorophenoxyacetic acid at a 0.15 percent concentration has aided in reducing or eliminating many broad-leaf weeds in the lawn, including nutgrass (*Cyperus rotundus* L.).

Once established, Manila grass should be fertilized

at least twice a year, preferably at the beginning and end of the dry season. If applied shortly before the beginning of the dry season, fertilizer aids considerably in maintaining a green color during the next 4 to 6 months of low rainfall. Although this grass is highly resistant to fertilizer burning, the usual precautions should be taken of sprinkling the lawn after fertilization or, if the fertilizer is applied when the blades of grass are dry, of sweeping it in with a broom. When a complete fertilizer consisting of nitrogen, phosphorus, and potassium (6–8–7 or 10–10–5) is used first, the second, third, and fourth applications can usually consist of nitrogen only in one of the forms listed previously. This is particularly true if the soil is medium to heavy in texture. About 0.5 pound per 100 square feet is a moderate application; Manila grass has taken two or three times this much nitrogen at Mayaguez without burning. A double application of fertilizer may be necessary under trees in order to provide adequate nutrients for both grass and trees.

Few Diseases or Pests

Under conditions in Puerto Rico Manila grass has shown no serious diseases or insect pests. During the rainy season a reddish-brown leaf spot may attack the blades, but this is of little consequence if the lawn is mowed regularly. The only insect observed is the Fall Army worm (*Laphygma frugiperda* A. & S.), which leaves its white dry epidermis at the tips of scattered blades. Damage is of minor importance.

Manila grass is receiving considerable attention in the United States and is showing promise as one of the best lawn grasses, especially south of the Mason-Dixon line. At this time there is no known commercial source of Manila-grass seed. A number of continental seed houses, however, are offering Manila-grass sod for sale. A large lawn can be established eventually from 1 or 2 square yards of sod, but this may take several years. About 5 acres of Manila-grass lawns have been established since 1936 at the Federal Experiment Station from an initial shipment of one-half square foot of sod from the Florida Agricultural Experiment Station.

ACACIA NEGRA INDUSTRY

(*Continued from page 141*)

Moida is sold in 40-kilo sacks, bark powder in 60-kilo sacks. In this form they may be sold to the tanneries, which make their own extract, or the *moida* may go to a tannin-extracting firm. At the present time liquid extract from 32° to 35°, Baumé scale, is being sold commercially, in 300-kilo wooden barrels. When tanners make the extract for their own tanning purposes, they produce liquid extract which is from 4° to 15° but do not sell it on a commercial basis. The 223 tanneries in the State produce an estimated 2,500 metric tons of liquid extract a year.

Tannin Extraction In Rio Grande do Sul

Total production of all liquid extract produced in Rio Grande do Sul would approximate 5,000 metric tons a year. In addition, an insignificant quantity of solid extract is produced, but not on a commercial basis.

There are three large firms in the State. The *Sociedade Extrativa Tanino de Acacia Limitada* was founded at Genuino Sampaio in 1943. This company produces 4,000–5,000 kilos of liquid extract of 35° Baumé every 24-hour day during a 6-day week. An analysis of a recent sample of their liquid extract indicated a pure tannin content of 47 percent. From 12 to 15 thousand kilos of bark are required each day to produce the 4 to 5 thousand kilos of extract at 35° Baumé in this plant. Operations extend throughout the year requiring the services of six to eight men. This company is enlarging its plant, hoping to double its output, and is also constructing a new plant at Taquari where solid extract will be produced.

A second company, known as *Vacchi & Cia.*, located at Esteio, near Porto Alegre, is said to have a liquid extract production of 2,500 kilos a day at 32° Baumé and a pure tannin content of approximately 40 percent. A third, the *Tanino Montenegro Limitada*, located at Montenegro, is reported to have a liquid-extract production of 500 kilos a day at 35° Baumé and a pure tannin content of 45 to 46 percent.

Three-fourths of the production of these three companies is estimated to be consumed in the local tanneries within the State, the other fourth being shipped to Rio de Janeiro and São Paulo. A number of new firms are in the process of organization for both liquid and solid extracting.

There seems to have been a general price decline on baled and shredded bark since 1933 because of constantly increasing supplies. On the other hand, prices of liquid extract have steadily increased since 1943 because there has been little competition in the extracting business and demand was greater than the supply. This condition is expected to change when more companies enter the extracting field. If prices for bark should advance for the producer in the next year or two, as is expected, much greater areas will be planted to *acacia negra* in Rio Grande do Sul.

ALONG THE *Agricultural Front*

▲ Sixteenth 4–H Club Camp Held in Washington

A better understanding of other nations and a sense of world as well as national citizenship were recommended as steps toward peace by 300 4–H Club members and leaders from all sections of the United States, as well as Canada, Hawaii, and Puerto Rico, who attended the sixteenth National 4–H Club Camp in Washington this summer. This was the first National 4–H Club Camp since the United States entered the war 5 years ago.

To promote international goodwill, the delegates recommended discussion in local 4–H Clubs on parent-child relationships "since the foundations of a stable government depend upon peace in the home." They also recommended study of 4–H Clubs of the United Nations, 4–H gifts of clothing and food for needy people in devastated countries, exchanges of letters between 4–H Clubs and foreign individuals and families, and 4-H scholarships for foreign students.

As evidence of their interest in world peace, the boys and girls suggested an addition to the national 4-H Club pledge so that each member will pledge his loyalty to "my world," as well as "my club, my community, and my country." It was announced that this change has already been made in the club pledge in Iowa.

Charles H. Hulten, of the United States Department of State, was among those who addressed the delegates during the week. He told the group of young people that the defeat of our enemies is but one step in a long undertaking to which the United States, whether it wished it or not, has become irrevocably committed. Victory is not an end in itself, he said, but only a means to an end—justice and security for other peoples of the world, and world peace.

Others who spoke included Secretary of Agriculture Clinton P. Anderson, who read a message to the group from President Truman; M. L. Wilson, Director of USDA Extension Service; C. B. Smith, former Chief of Extension; Dr. Paul F. Douglass, President of American University; E. F. Pineau, Federal Department of Agriculture, Ottawa, who brought greetings from 35,000 members of boys' and girls' clubs in Canada; and César A. Calderón, 4-H Club leader from Puerto Rico, who presented greetings from the Island's 12,000 club members. Also introduced were Señorita María M. Gil de Lamadrid, 4-H leader, and 4-H Club members Consuelo Vaquer and Francisco Aponte, all of Puerto Rico; and Gonzalo García Castaneda, of the Tingo María Experiment Station, Peru, who is studying Extension Service educational methods in the United States.

Carnation leis (garlands), flown from Hawaii, were presented, Hawaiian style, to Director Wilson and to Miss Gertrude Warren, 4-H Club Organization Specialist, USDA, by Mrs. Alice Trimble, Home Management Specialist of the Hawaiian Extension Service. In presenting the lei to Mr. Wilson, Mrs. Trimble read a note of greeting which had been sent by Director H. H. Warner of the Hawaiian Extension Service. The message from Mr. Warner read: "Greetings to our Number One Boss with Aloha from Hawaii—the 49th State, and from 5,000 4-H Club members."

▲ USDA Announces 1947 Training Program

As a part of the cooperative program between the United States and the other American Republics, the United States Department of Agriculture recently announced its 1947 agricultural in-service training program. A limited number of qualified citizens of the several American countries are offered opportunities for specialized instruction and training in Federal and private institutions and agencies in the various branches of agriculture.

Training grants are of the in-service type and may include assignments to certain agencies of the USDA for varying periods, courses in the USDA Graduate School, work with leading agricultural specialists and engineers, observation and practical experience in one or more of the regional, State, or county offices throughout the United States, study and observation in governmental laboratories or field stations, and in private institutions. Trainees will have full opportunity to become familiar with broad agricultural problems and with the programs developed to solve them. Facilities of libraries, research, and educational institutions will be made available to the trainees as needed.

First preference in the selection of candidates will be given to those working with the cooperative agricultural station program. In addition to health and language prerequisites, those selected must be college graduates and not more than 35 years of age. For further information regarding the program write to the Office of Foreign Agricultural Relations, United States Department of Agriculture, Washington 25, D. C.

▲ Tung-Nut Crusher Established in Paraná

In northern Paraná, Brazil, eight of the largest growers of tung nuts have formed a company for the crushing of the nuts to obtain tung oil. They secured their equipment and had their mill, which is located in Cambara, in operation this spring. They plan to sell their oil in drums to the highest bidder whether in Brazil or in a foreign market. Excellent growing conditions have produced a heavy harvest of nuts this year.*

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*The February 1943 issue of *Agriculture in the Americas* carried an article "Tung Growing in Latin America" which tells of the production and uses of tung oil.

PATAGONIA'S RIVERS AND AGRICULTURE

by OSCAR MOORE

Southern Argentina, from the Río Negro to the Strait of Magellan, and Argentina's part of the island Tierra del Fuego, which is south of the Strait, constitute Patagonia. The name Patagonia, meaning big feet, was given by the early explorers to the aborigines in the region. It comprises one-third of the area of Argentina and approximates the States of Texas and Louisiana in size. About 1 percent of the nation's 14 million inhabitants live in Patagonia, chiefly along the irrigated northern river valleys and in the small coastal towns. The principal industry is sheep grazing, which is carried on at large. Crops are restricted to a few irrigated river valleys and to the deep valleys in the Sub-Andean Depression of the western lake region.

Patagonia stands apart from northern Argentina by virtue of its colder climate, its semi-aridity, and its plateau topography. It is characterized by stormy, shifting, cloud-laden winds that blow steadily throughout the year and are bitterly cold in winter. These winds create a haze of dust that limits visibility. Ranch houses are generally located in the protective canyons that dissect the plateaus from east to west and afford protection from the elements.

Along the Atlantic coast cliffs mark the edge of the plateaus. Ocean-going vessels can land at the Chilean port of Punta Arenas in the Strait of Magellan and at Puerto Madryn on the Patagonian coast, but between these ports the tidal range is so great that they cannot land in the river bays.

From the coast, level plateaus, divided at intervals by canyons, extend westward to the Andes. At places the dry, cold, isolated Patagonian plateaus are as high as 5,000 feet above sea level. In the west, they terminate abruptly in cliffs which are separated from the steep upward slopes of the Andes by a narrow lowland belt called the Sub-Andean Depression. This is a continuous depressed passage from Punta Arenas on the Strait northward to a point above Lake Nahuel Huapí except for a few interruptions by spurs of the Andes.

Except for the City of Neuquén, situated on the upper Río Negro at the confluence of Ríos Neuquén and Limay, the principal settlements are located near the Atlantic coast. Many inhabitants of these settlements and the shepherds of the hinterland immigrated from Scotland, Germany, England, and

(*Continued on back cover*)

U S DEPARTMENT OF AGRICULTURE NEG. 750 OFFICE OF FOREIGN AGRICULTURAL RELATIONS

Reading about the AMERICAS

Brazil, by Preston E. James. 262 pp., illustrations and maps. The Odyssey Press, New York, 1946. The text of this book is a reprint of the section on Brazil in the author's *Latin America* published in 1942. The data have been brought up to date and new material added, particularly to the last chapter, "Brazil as a Political Unit." The author is a geographer, essentially a "human geographer," and he takes us over the different regions of Brazil—Northeast, Southeast São Paulo, the Sertões, the South, the North—in an attempt to determine why vast areas are so sparsely populated. He discusses the climate, natural vegetation, crops already grown and possibilities of new ones, the sugar, cotton, coffee, cacao, and rice fâzendas, livestock grazing, and the racial make-up of the people.

Village in the Sun, by Dane Chandos. 260 pp. G. P. Putnam's Sons, New York, 1945. This is a book about a small Mexican village on Lake Chapala in the mountains south of Guadalajara. From it we learn much about Mexican customs, life, and ideas, though the author states that it is not a book about Mexico but, rather, a book about Ajijic and the Indios who live there.

The book is divided into 12 chapters, each covering the events of a month, beginning with June. The author, who has decided to settle down in the village to do his writing, records intimately and simply, but with a strongly humorous and philosophical sense, the life in his temporary abode during the year while his own house is being constructed on his newly acquired land. We come to know personally Candelaria the cook, Nieves the maid, Cayetano the gardener, and Venustiano the land owner. We share the pleasure of arranging, for the new home, the *potrero*, the garden in which only small things like tomatoes and peanuts are planted, and the *huerta*, where fruit trees of many kinds also grow. "In Ajijic," Venustiano assures us, "everything gives. Here there lacks nothing but the impulse of man. Come, and I will show you what I have in my garden. It is enormous of big. It is the biggest squash I have ever seen."

Let's Visit Mexico, by Byron Steel. 425 pp., illus. Robert M. McBride & Company, New York, 1946. Many changes have taken place in Mexico during the last few years. Here is a new guide book, designed to give up-to-the-minute information on transportation, resorts, hotels, points of interest, railroad, automobile, and city maps, a special section on Mexico City, and details of tourist cards, customs regulations, and money equivalents. In the appendix are practical travel hints—a list of everyday expressions in Spanish, calendar of fiestas, significant dates in Mexican history, distances of tourist towns and cities from centers, shopping guide, suggested itineraries ranging from 2 to 30 days, and a bibliography of fiction and nonfiction about Mexico.

Latin American Civilization, Colonial Period, by Bailey W. Diffie. 812 pp., pictures and maps. Stackpole Sons, Harrisburg, Pa., 1945. Here is a book designed to answer fully and without prejudice the many questions that arise about Colonial Latin America. The author "weaves together . . . literally everything . . . that is available to us in ethnology, anthropology, sociology, economics, politics, and culture." Among other topics, several chapters are devoted to agriculture in the different parts of Latin America before the Spanish Conquest and to agricultural development throughout the Colonial period. The book covers not only the Conquest and the moment of Independence but the 300 years between. In the last section a similar analysis is given of Colonial Brazil.

Cuba: Tierra Indefensa, by Alberto Arredondo (prolog by De Ramiro Guerra). 500 pp. Editorial Lex, Habana, Cuba, 1945. This is the first in a series of three books concerned with the economic life of Cuba. It deals with the period from 1492 to 1933, tracing, among other things, the economic development of sugarcane, coffee, tobacco, the livestock industry, small fruits, and the land.

Editor's Note—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

AGRICULTURE IN THE AMERICAS — O. R. CARRINGTON, EDITOR

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GIFTS OF THE AMERICAS

SARSAPARILLA

by BEATRICE DU FRANE

Like a comet, sarsaparilla has skyrocketed across the medical universe, faded into virtual oblivion, and flashed once more into prominence.

Native to the Americas, sarsaparilla was introduced into Europe about 1536 A. D. The drug was widely used by European physicians during the sixteenth century in the treatment of syphilis, but gradually its popularity waned. About the middle of the eighteenth century, however, sarsaparilla once more won medical approval. From that time until a hundred years later, the drug was considered highly effective as an alterative in the treatment of certain skin diseases, syphilis, scrofula, and chronic rheumatism. Toward the end of the nineteenth century sarsaparilla once more fell into disfavor with the medical profession and its remedial properties were relegated to legend. Only its use as a vehicle, or syrup medium in which medicines are administered, saved it from oblivion. Today, sarsaparilla is considered valuable in some quarters because of its ability to increase the absorption of other drugs by the intestinal tract. Its chief use now is as a vehicle in pharmaceutical preparations, but it is also sometimes used as a flavor in beverages.

Sarsaparilla is obtained from the dried roots of several species of *Smilax* which grow in Jamaica, Mexico, Central America, and the warmer areas of South America. Complete identification of these commercially accepted species of *Smilax* has not yet been made. *Smilax officinalis*, *S. papyracea*, and *S. aristolochiaefolia* (*S. medica*) are believed to furnish most of the drug-bearing roots. *Smilax officinalis* is also known as Jamaica sarsaparilla and *S. aristolochiaefolia* as Mexican sarsaparilla. Other commerically marketable roots are known by various names, based on the area from which they are obtained, as Lima, Honduras, Guayaquil, and Guatemala sarsaparilla.

The derivation of the word sarsaparilla, compounded of the Spanish words *zarza*, meaning bramble, *parra*, meaning vine, and the diminutive ending *illa*, is descriptive of the officially identified plants from which the drug is obtained. These plants are tough, perennial, climbing shrubs with prickly stems, square or round in shape. They bear small flowers and berry-like fruit. The leaves are veined, usually shiny, and vary in shape. The slender, creeping roots, from which sarsaparilla is extracted, are long and radiate from a common rhizome, from which the stems also spring.

Sarsaparilla plants may be propagated by seed, layers, cuttings, or suckers. Best results are obtained from plants grown in sandy, well-drained soil, rich in humus. Young plants should be spaced about 6 feet apart, with trellises or stakes provided for the growing vines.

Roots of sarsaparilla plants may be harvested annually, with the first harvest taking place from 2 to 3 years after planting. Only the larger roots are cut, after which the base of the plant is carefully covered with soil. The hardy shrubs soon develop new roots. When the natives dig up wild plants, all of the roots are usually harvested. Because of their great length, several hours may be required to extract the roots from the soil and to separate them from the roots of other plants. The harvested roots are dried and then packed for shipment.

Sarsaparilla may be extracted by boiling the dried roots in water or in alcohol. Powdered sarsaparilla ranges from pale yellowish orange to pale brown in color. In addition to three saponins (*smila-saponin*, *sarsa-saponin*, and *parillin*) the roots also yield paroaparic acid and resin.

Sarsaparilla that has been obtained from old plants or inferior varieties of *Smilax* tends to be inert. Taste is considered a sufficient test of root quality. Almost odorless, sarsaparilla is rather sweet, acrid, and sticky to the taste. Sarsaparilla that is highly acrid is of the best quality; sarsaparilla that is not acrid is considered useless.

The roots of a number of plants have been used as substitutes for true sarsaparilla. Among these are certain species of *Pteris* and *Philodendron*. The roots of *Menispermum canadense* are known as Texas sarsaparilla. Other adulterants are obtained from the roots of *Aralia nudicaulis* and *A. hispida*. In Australia the root of *Hardenbergia* replaces true sarsaparilla. In India a plant known as *Hemidesmus indicus* is used; in Italy, a plant known as *Smilax aspera*.

Despite these substitutes, the true sarsaparilla of commerce pursues its topsy-turvy career, especially in the medical field, as it has done for centuries.

PATAGONIA'S RIVERS AND AGRICULTURE

(*Continued from page 149*)

Wales. Still others came from the British-held Falkland Islands off the coast, where also sheep are raised. Three railways extending from coastal cities to the interior are active chiefly when wool moves to ports. Several points are served by coastwise steamers. Lamb, mutton, wool, and fruit are exported from coastal points to enter into international trade.

Seven important rivers and several lesser ones originate in the Andes and flow eastward across Patagonia to the Atlantic. Named from north to south the important ones are the Negro, Chubut, Deseado, Chico, Santa Cruz, Coyle, and Gallegos. Because of insufficient rainfall, the northern streams go dry at times, but the southern rivers flow continuously because of heavier rainfall, lower temperatures, and water received steadily from large glacial lakes.

Climate and Vegetation

The latitude of the northern boundary of Patagonia, south of the Equator, is about the same as that of Philadelphia in the North; latitude of the southern extremity of Tierra del Fuego is equivalent to that of northern Newfoundland. Patagonia's climate is conditioned by the moderating influence of the ocean. The South American Continent narrows toward the south so that no part of Patagonia is far from the sea. Thus, there is not a great seasonal range of temperature. In fact, seasonal temperatures show a wider range in northern Argentina than in southern Patagonia, but average temperatures in the south are lower. In Tierra del Fuego the temperature during the warmest month, January, averages about 50° and during the coldest month, July, about 35° F. For its latitudinal position, these are moderate temperatures. Snow falls every winter as far north as Buenos Aires Province, which is located north of Patagonia. Seasons in Argentina are reversed from those in the United States, and the farther south one goes, the colder it gets.

Patagonia lies in the rain shadow of the Andes, which means that, although rain is heavy on the Chile side, generally less than 10 inches fall in Patagonia. Rain comes principally in the summer—October to March—in the north, but it is fairly evenly distributed throughout the year in the south. There is one small isolated area of high rainfall just south of Lake Nahuel Huapí where it reaches a maximum of about 40 inches yearly. This is one of the world's unusual areas in this respect.

The plateaus throughout most of the length of Patagonia are covered by a sparse growth of shrubs and grasses. The vegetation of the valleys is more abundant. In the west on the upward slope of the Andes, forests are found because of greater rainfall. Annual rainfall increases from 12 to 36 inches from northern to southern Tierra del Fuego, but because of low temperature all year, shallow soils, and strong winds, plant life is limited to a heavy growth of grass. Heavy sea fogs are prevalent over the land of the far South.

Agriculture

The only croplands that warrant mention in Patagonia are found along the Río Negro, lower Río Chubut, and in the deep valleys of the Sub-Andean Depression south of Lake Nahuel Huapí in the previously mentioned high-rainfall area. Along the floor of the river valleys crops are cultivated under irrigation. Since the rivers are from 100 to 300 feet below the surface of the plateaus through which they pass, the cropped areas are protected from the strong winds.

Argentina's principal fruit-producing center is located in the Río Negro Valley, where intensive farming is practiced and settlement is dense. An irrigable area of 150,000 acres is served by the Río Negro-Nequén dam in this valley. Farms average 15 acres in size and many of them are intensively planted to apples, pears, peaches, plums, quinces, and grapes. These fruits are sold domestically, or exported to Northern Hemisphere markets under advantage of reversed seasons. Some farmers grow vegetables extensively, others produce alfalfa seed, and still others grow diversified crops. In the Río Chubut Valley alfalfa, wheat, fruit, and vegetables are grown but on a smaller scale than in the Río Negro Valley to the north. The valleys south of the Chubut are too cool for crops.

The Sub-Andean Depression of southwestern Patagonia is one of the picturesque regions of the Continent. A chain of sapphire-colored glacial lakes, including Lagos Nahuel Huapí, Buenos Aires, Viedma, and Argentino, are situated in evergreen forests below beautiful snow-covered Andean peaks. Wheat, vegetables, and fruits are grown without irrigation in the high-rainfall area south of Lake Nahuel Huapí for local needs and to provision shepherds living in the outlying areas.

Some cattle are raised, particularly on the better pasture lands of the northwest. Sheep grazing, however, is the major industry, and sheep are raised throughout Patagonia except in the Andes. About half the nation's wool is produced here. Mutton and lamb production centers in the south where several packinghouses and meat-freezing plants are located, and wool production centers in the north. Sheep are concentrated in great numbers on the humid pasture lands just to the north and south of the Strait of Magellan. Virtually all sheep ranches are larger than 1,500 acres, some exceeding half a million, and are greatly isolated. Low carrying capacity of the land necessitates a large pasture area per animal.

Regardless of a number of obstacles, Patagonia contributes to Argentina's economy, and its mutton, lamb, wool, and fruits are found on foreign markets thousands of miles away. Some of its farm lands are located farther south than any others in the world.

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October 1946

NAMES & NEWS

Brazilian Veterinarian Visits United States

Dr. Max Erhart, Professor of Veterinary Anatomy of the University of São Paulo, São Paulo, Brazil, recently completed a visit to the United States during which time he made a study of the methods used in meat and dairy inspection and in the teaching of veterinary medicine.

●

Samuel H. Work Goes to Central America

Dr. Samuel H. Work, Animal Husbandman for the Office of Foreign Agricultural Relations, is visiting El Salvador, Guatemala, and Nicaragua where he will assist with the animal-husbandry programs at the cooperative agricultural experiment stations in these countries. On the same trip Dr. Work will discuss animal-husbandry problems with officials of the *Escuela Agrícola Panamericana* in Honduras, Inter-American Institute of Agricultural Sciences in Costa Rica, and National School of Agriculture in Panama.

●

Panamanian Official Studies Small-Farm Rehabilitation

Señor Teodoro E. Méndez, of the Panamanian Department of Agriculture, is visiting the United States under the sponsorship of the Institute of International Education for the purpose of studying irrigation, rural road and bridge construction, and rehabilitation of small farms.

●

Dr. Lelio Martínez Villalba Comes to the United States

Dr. Lelio Martínez Villalba, of the *Instituto de Fomento Industrial,* Bogotá, Colombia, recently spent 3 months in the United States investigating modern fruit and truck-crop production methods, the processing and packing of fruits and vegetables, and methods of producing starch from root crops.

U. S. Scientists Visit Turrialba

Ralph H. Allee, Director of the Inter-American Institute of Agricultural Sciences, Turrialba, Costa Rica, announces that a number of scientists from the United States will carry on research work at the Institute during the coming year. These include Dr. Walter N. Bangham, Director of Rubber Research for the Goodyear Company, who has been loaned to the Institute to assist in establishing a research program; Dr. Ora Smith, Professor of Vegetable Crops at Cornell University; and Dr. Hans Jenny, Head of the Department of Soils at the University of Southern California. Mr. Allee says that increasing numbers of scientists from the United States are finding opportunities for carrying on research at Turrialba.

●

Arthur G. Kevorkian Heads Harvard Arboretum

Dr. Arthur G. Kevorkian, who has been serving for the last 2 years as Director of the Cooperative Agricultural Experiment Station at El Recreo, Nicaragua, resigned recently from OFAR to become Director of the Atkins Institution, a tropical arboretum of Harvard University. The arboretum is located on Hacienda Soledad, Cienfuegos, Cuba, and is used for graduate study and research. It is said to have one of the finest collections of living tropical plants in the world.

●

Albert L. Burkett Assigned To Cuban Experiment Station

Albert L. Burkett Agricultural Engineer for the Office of Foreign Agricultural Relations, has been assigned to the Cuban Agricultural Experiment Station under the Memorandum of Agreement between the Governments of the United States and Cuba. Mr. Burkett will be in charge of agricultural engineering work at the Cuban Station, and will work primarily on the mechanization of harvesting and defibering kenaf.

●

Mexican Agronomist to Study U. S. Wheat Grading

Ing. Agr. Felipe Pérez y Pérez, Agronomist of the Mexican Department of Agriculture, has come to this country for a period of 6 months to make a study of wheat grading.

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Colombia Goes Ahead In Transportation and Agriculture

No one factor plays a greater part in the development of the agriculture of a country than the means of transportation available for getting materials to farms and produce to markets. In a mountainous country like Colombia the dependence of agriculture on transportation is particularly evident.

by RAYMOND E. CULBERTSON

Since its origin Colombia has been retarded and in many sections completely isolated through lack of transportation. Only those who have traveled in Colombia and know its steep mountains, its many rivers and deep gorges, its changing seasons, which result in frequent floods and highway washouts, and its shifting river channels and sandbanks can appreciate the progress which the country has made in spite of geographical barriers of all kinds.

For many years the only way to get to Bogotá, the Colombian capital, located in the Andes Mountains 8,600 feet above sea level, was to embark at Barranquilla, a port on the Carribbean Sea, chug some 600 miles up the Magdalena River in a slow river boat, and then travel by muleback about 85 miles over mountain trails. Bogotá still lacks through-railroad connection with the coast, but there is a connecting railroad to the Magdalena River, and by combination railroad and highway one can also now reach the Pacific.

Transportation Influences Agriculture

Strange as it may seem, the use of horse-drawn vehicles has never attained much prominence outside the cities in Colombia. The four-wheeled wagon is seldom seen and only a limited use is made of the two-wheeled cart. When it is used, it is drawn by oxen. Most of the transportation in the country is by pack mules, burros, and the backs of men—more frequently women—over narrow trails.

The effect of this kind of transportation upon agriculture down through the years is obvious. For a crop like potatoes, for example, it is not uncommon for the seed potatoes, the fertilizer, and spray materials to be carried on muleback several miles to the fields, and the resulting crop to be transported in the same way. Thus, such recommendations as the use of fertilizers, lime, and other agricultural aids are difficult and costly to carry out.

Except for riding, horses are seldom used on the farms or on the highways. Oxen are preferred, on the grounds that the laborers can handle them better, and then when their usefulness as draft animals is over, they can be eaten or sold for meat. No consideration is given to the loss in time and inefficiency resulting from their use.

Of course, there are well-to-do farm operators who, living in sections where highways have been constructed, have trucks and tractors. Such agricultural machinery is, however, the exception.

River Transportation Important

Transportation by boat has always been paramount in Colombia. Over the years, river transportation has changed very little. Some improvement is noticed in

Dr. Culbertson is Agronomist in the Office of Foreign Agricultural Relations, U. S. Department of Agriculture. Recently he served on a mission to Colombia assisting that country in making a survey of its agricultural resources.

Only those who have traveled in Colombia and known its steep mountains, its many rivers and deep gorges, can appreciate the progress which the country has made in spite of geographical barriers.

the form of a few luxury river boats on the Magdalena, but the usual mode of travel on the larger rivers is on friendly slow-moving paddlers, which make frequent stops to bargain for wood, to take on all kinds of livestock and river cargo, while passengers loll on the decks, tend their babies, visit the stops, and patiently wait for more beverages and food to be served. The depth of the streams in the dry seasons more or less limits the weight and draught of the boats which can be used, but dugouts are found on all the rivers, regardless of their size.

There are some 13 or 14 navigable rivers in Colombia. The Sinú is navigable for only 90 miles, but it carries boats of 200 tons and serves the State of Bolívar. Two of the three frontier States on the south are served by the 1,080-mile-long Putumayo and the 1,020-mile-long Caqueta Rivers, which carry boats of 300 tons and flow into the mighty Amazon. The Atrato, which carries products from Choco and Antioquia, has 330 navigable miles, and boats of 1,500 tons go up and down its length. The Upper and Lower Cauca together have about 430 navigable miles, and, though only 150-to-200-ton boats may travel on them, they carry products from the well-known Valle del Cauca, Bolívar, and Antioquia to the Magdalena and thence on to Barranquilla. In the eastern part of the Republic are the Meta, navigable for 570 miles and accommodating boats of 300 tons, and the Guaviare, with 372 miles, both flowing into the Orinoco, which for 150 miles along the border between Colombia and Venezuela carries boats of 300 tons. Carrying products to the Pacific are the Patia and the San Juan, in boats of 100-150 tons. Chief of all rivers in Colombia is the Magdalena, which is deep enough for boats of up to 5,000 tons. It carries on its 840 miles of navigable waters products from Antioquia, Boyaca, Tolima, Cundinamarca, Huila, Magdalena, Atlántico, Bolívar, and Santander.* On these rivers much of Colombia's freight is still moved.

**See* "Down the Magdalena," by W. E. and Linda Dunn, in the August 1945 issue of *Agriculture in the Americas*.

Highways and Railroads

About 1925 emphasis began on highway construction. It is estimated that there are now about 10,000 miles of national and Departmental highways, with an estimated 500 miles of the total paved. However, the important cities of Cartagena, Barranquilla, and Santa Marta are still not connected by highways with the interior. Only trails penetrate the eastern part of the country, and side roads or farm-to-market roads are practically nonexistent. Farm products must still be carried to market in some other way.

The building of railroads has been slow and spotty, with few extended lines. In 1871 the first railroad, the Bolívar, was completed, extending 16 miles from Barranquilla to Puerto Colombia. Between that year and 1915 several comparatively short roads were constructed. The Antioquia Railroad of 101 miles connects Medellín and Puerto Berrío. The Pacific Railroad of 104 miles connects the vital seaport of Buenaventura with Cali and the inland. The La Dorada goes around the impassable rapids on the Magdalena. The Girardot-Bogotá Railroad, 106 miles long, was begun in 1881 and completed in 1889 after having United States, British, and Colombian companies working successively on the project. The Santa Marta Railroad, 56 miles long, connects Santa Marta and Fundación. A road goes from Cartagena to Calamar on the Magdalena, a distance of 63 miles. Connecting Bogotá and Nemocon, a 37-mile road was finished after 16 years. Seventy miles of railroad between Ibagué and Girardot was begun in 1893 and finished in 1921. The Southern Railroad extends for 19 miles between Bogotá and El Salto, and the Amaga Railroad between Medellín and the Cauca River. According to J. Fred Rippy, author of *A History of the Rail oad Era in Colombia*, up to 1915 approximately 700 miles had been constructed.

Between 1915 and 1940 construction was somewhat more rapid, resulting in approximately 1,300 miles of track being laid. One can now travel by rail from Neiva through Bogotá to Barbosa, and from Popayan by way of Cali and Medellín to Puerto Berrío. All but a few short lines are now government owned.

In a country with an area of 450,000 square miles, however, 2,000 miles of railroads is only a beginning. Plans are now under way to connect Ibagué and Armenia, thus completing the link between Bogotá and Buenaventura on the Pacific; to build a road from Medellín to Cartagena; to extend the Northern from Barbosa to Bucaramanga; and, in the south, to extend the line from Popayan to Pasto, the capital of the Department of Narino. The effect which this increasing railroad mileage will have upon the agriculture of the country can hardly be estimated.

Courtesy of Office of Inter-American Affairs

Plans are under way for a considerable increase in railroad trackage during the coming years. The effect of expansion upon the agriculture of the country can hardly be estimated.

Air Transportation

Beginning in 1920, the most pronounced progress in transportation to all parts of the country has been due to the airplane. Airlines now connect almost all the important cities and many outlying towns previously isolated or reached only by weeks of travel. From Bogotá to Medellín now requires about an hour by air instead of 2 days of hard driving by car.

Cattle are sometimes driven long distances to market, losing much weight during the journey.

Cattle and other livestock are often transported by river barges.

Several companies operate in Colombia. Avianca provides service throughout the country and has an aggregate of some 10,000 miles of air routes. UMCA, in connection with Panamerican Airways System, Inc., and Panamerican-Grace Airways, Inc., flies from Medellín to Panama and, in agreement with Avianca, from Barranquilla to North America. Panamerican-Grace Airways, Inc., operating through Cali, connects Panama with the countries to the south. Compañía Real Holandesa de Aviación connects Barranquilla with Venezuela and the most important Caribbean islands. In the past few years TACA has attained prominence, especially in the transportation of freight to out-of-the-way places. If a fairly level field is available, TACA will deliver livestock, farm supplies, or pick up passengers or cargo.

Agencies Bring About Progress

Colombia's agricultural development is directly tied in with all these various transportation facilities. The lack of highways and railroads, accompanied by high transportation costs, continues to hold back a rapid development of agriculture. A great deal of progress is being made each year, however, through intelligent programs by such agencies as the Department of Agriculture, the *Caja de Crédito Agrario Industrial y Minero*, the Coffee Growers Federation, the long-established and far-reaching National Society of Agriculture, the Colombian Livestock Association, and the National Supply Institute.

With funds amounting to 22,100,000 pesos (approximately $12,600,000) to cover the 5 years 1945–49, the Department of Agriculture is increasing the work at the experiment stations, intensifying extension work on the major crops, carrying on soil studies, emphasizing insect and disease control, inaugurating agricultural economic studies, and planning for a section of agricultural engineering. It is also planning to send about 20 promising outstanding students to the United States each year for special agricultural training and to bring in technicians, principally from the United States, to work with Colombians in improving the agriculture of the country.

The *Caja de Crédito Agrario Industrial y Minero*, through its various agencies, is helping farmers by loans on homes, livestock, and crops. It is importing and selling fertilizers, farm seeds, machinery, and general farm supplies at a low margin of profit in more than 100 stores throughout the country; is developing four large irrigation projects; financing and managing fertilizer and lime plants; fostering seed production; cooperating with the United States Department of Agriculture in rubber growing; manufacturing insecticides and fungicides; and formulating plans for colonization. The proposed construction of a slaughterhouse at Villavicencio will result in a meat saving of about 100 pounds per animal, which normally is lost in driving them some 70 miles over the mountains to Bogotá.*

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*See "Colombian Cattle Transportation," by John A. Hopkins, in the April 1946 issue of *Agriculture in the Americas*.

Over the years river transportation has changed very little in Colombia. The depth of the rivers more or less limits the weight and draught of the boats, but dugouts are found on all the rivers regardless of size.

U. S. DEPARTMENT OF AGRICULTURE NEG. 769 OFFICE OF FOREIGN AGRICULTURAL RELATIONS

The Coffee Growers Federation, in addition to investigations with coffee, is fostering soil conservation and working toward improvement in living conditions in the coffee zones. The National Society of Agriculture is interested in the over-all picture and has probably done more than any other group in fostering new programs. The Livestock Association and the Department of Livestock are importing purebred animals from the United States at the rate of something like 1,000 head yearly. In addition, the Department of Livestock has 13 *puestos de monta*, breeding stations, where the services of selected stallions, bulls, and boars are free to community livestock producers, and several stations for the breeding and improvement of livestock.

In 1944 the National Supply Institute was created with broad powers, among which are the importation of food products, establishment of warehousing and processing plants, establishment of satisfactory farm prices, purchasing, holding, and disposal of surpluses. At the same time it has the functions of a Price Control Board.

Although natural barriers will continue to delay agricultural development to some extent in Colombia, with its progressive people and rich natural resources one can predict a bright agricultural future.

Sesame

The word "Sesame" has had various meanings in legend and literature, but in the modern food and trade sense it means a tiny seed which yields chiefly a useful vegetable oil.

by DALE E. FARRINGER

Sesame has become an important oil crop in the Western Hemisphere only within the past decade. In 1945, approximately 100,000 short tons of sesame were grown in Latin America, a 10-fold increase over the 1935-39 average. World production during 1945 was estimated at nearly a million and a half tons. China was by far the leading grower, producing around half the world total, with India supplying about one-third, and Latin America and Africa the remainder.

This seed crop has been grown in Asia since ancient times. Evidence indicates that both black and white seeds have been cultivated in India for many centuries, perhaps prior to the Aryan invasion. Botanical evidence points to Africa as the place of origin of this plant, where some eight or nine wild forms were said to have been found. One early writer argues that sesame is indigenous to the Netherlands East Indies. From either or both of these sources the plant was brought to India and China.

The origin of the word sesame is obscure. Latin authors frequently used the word *sesamum*, and Greek writers, *sēsamē*. Some of the names used by the Indians for the seed, such as *gingeli* and *jinjili*, probably came from Arabic or Persian, and *til* from Sanskrit. The Indians still use some of these names today.

Sam-sam and *sim-sim* are Arabic names for the plant as well as for the magic word "Sesame" used by Ali Baba in opening the legendary cave of the 40 thieves in *The Arabian Nights*. So far as is known, the use of the phrase may have been suggested by the small impervious capsule, bearing a treasure of oilseeds which are freed by the bursting of the capsule when the plant matures.

Uses of Sesame

Although sesame is a relatively minor crop, the seeds and oil have a variety of uses. In many parts of the world the seed is well known as an adornment on bread and rolls. To a lesser extent it is used in candy and in a refreshing drink called *horchata*. The oil, usually pale yellow when refined, is used as a salad and cooking oil and as a component in the manufacture of margarine, shortenings, and soap. Sometimes it is mixed with olive oil as an adulterant. Small quantities of sesame oil find outlets in the pharmaceutical and perfume industries. In some countries the oil is still used as an illuminant.

The leaves, when submerged in water, form a mucilage-like substance used in treatment of diarrhea and dysentery. The pressed cake makes an excellent livestock feed, containing from 10 to 20 percent oil, depending upon the method of extraction and conditions of growth.

The Plant

Sesame is a member of the Pedaliaceae family, which consists of 16 genera and some 60 species. *Sesamum indicum* is the most important species cultivated in tropical and subtropical regions. It grows best on well-drained, sandy-loam soil, sheltered from strong winds and torrential rains. Frequently, however, the plant must endure hardships in many countries as it is grown on hillsides or around huts where conditions may not be suitable. The yield, of course, depends on soil, moisture, weather, and care.

The plant is an erect annual, which usually grows 2 to 5 feet high, depending on the variety and growing conditions. Flowering starts when the plants are 2 or 3 months old and extends over a considerable period. The flowers are tubular, two-lipped, and are about three-fourths of an inch long. The color varies from pink to yellow. They produce an oblong seed pod or capsule which is about 1½ inches long and the width of a pencil. While pods are forming on the lower portions of stalk, flowers are still blooming at the top.

The two-valve pod, or capsule, contains from 80 to 84 seeds, which are arranged in four rows. The seeds vary in size, weight, and color depending upon the variety and growth. They are generally white or pale yellow in color, although dark red, brown, and black

An excellent field of sesame in the State of Guerrero, Mexico. Although China is the leading producer, sesame is found growing in the Pacific lowlands extending from Mexico through Central America, the West Indies, and certain parts of Brazil, Venezuela, Colombia, Peru, and Ecuador.

seeds are sometimes produced. The size of unimproved varieties is about that of a flaxseed, and generally they are pear shaped. Oil content varies from 45 to 55 percent. White seeds are reported to yield a superior quality of oil, but less quantity, than the dark-colored varieties.

Primitive planting methods are commonly employed, since sesame is grown in regions of abundant labor where little farm machinery is used. Frequently, seeds are dropped in plow furrows and covered by the laborer's foot. In some localities the farmers do not bother to plow. They merely punch a hole in the ground at intervals, and drop in a few seeds. A hand-planting device, consisting of a bottle with a perforated stopper in which a mixture of seeds with sand or sawdust is placed, has been suggested but is believed to be little used.

Six to ten days after planting, the seeds germinate. When the plants are about 1½ inches high and have four leaves, thinning out and weeding are begun. These operations are usually done by hand. The spacing varies, but on an average the distance between plants is about a foot, and between rows about 2½ feet. The wider the spacing, the more the plants tend to branch instead of growing into a single stalk. If plants are allowed to branch, the harvesting is more difficult, although the yield of seed is about the same.

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Oblong seed pods or capsules of sesame are about 1½ inches long and the width of a pencil. Harvesting is sometimes made difficult because the seed capsules and seed stems do not all mature at the same time.

Difficulties in Harvesting

Harvesting sesame, which begins 110 to 140 days after planting, presents special difficulties. Generally, the plants are cut when the leaves turn yellow, shortly before the majority of the capsules ripen and start to open. The first capsules to mature are the lower ones. Often they open and discharge their seeds while the others are still green. Timing the cutting in order to obtain the maximum yield is an extremely important factor. If the cutting is too late or is not done rapidly enough, a large part of the crop may be lost. Planting should also be timed so that it will be ready for harvest when the dry season begins. Great losses are suffered if rain falls during the cutting or drying periods.

Until recently no successful machinery had been devised for cutting or threshing; both were hand-labor jobs. A recent report from Venezuela, however, announces a demonstration made by the Ministry of Agriculture that sesame can be efficiently harvested with a wheat binder equipped with a heavy cutting bar. The use of this method may greatly increase the acreage planted to this valuable seed. If the cutting is done with a hand knife or sickle, care must be taken not to shatter the seeds from the matured capsules.

After cutting, the stalks are tied and usually arranged in shocks varying from 12 to 16 bundles. In this manner they are left to dry in the sun for several days, permitting the green capsules to ripen and to open.

For threshing, the bundles are shaken or laid out on a cloth and beaten with a stick or trampled out. The foreign matter usually is separated by hand or winnowed by throwing the material into the air. In some localities, cleaning machines which are used for small grains are suitable for sesame. Since not all seeds are freed by the first threshing, in many cases the stalks are redried and threshed again. According to some authorities, hand harvest and threshing represent from 37 to 60 percent of the production cost, making sesame a profitable crop only in regions where an abundance of hand labor exists.

Grows in the Americas

The Pacific lowlands extending from Mexico through Central America, the West Indies, and certain parts of Brazil, Venezuela, Colombia, Peru, and Ecuador seem particularly well suited to the growth of sesame. Regions of tropical scrub forest with scattered savanna openings, where the rainfall is seasonal and not excessive, offer the best prospects for its cultivation in the Western Hemisphere. During the growing season as little as 20 inches of well-distributed rainfall is considered sufficient to produce a good crop.

MEXICO:—In Mexico, sesame is generally grown at fairly low elevations where the temperature is 70° or above. A large part of it is concentrated in the valley of the Río Balsas, which forms the boundary between the States of Guerrero and Michoacán. Other important growing areas are in the States of Sinaloa and Sonora.

The two common varieties in Mexico are known as the *trigueña* or *morena*, the most widely cultivated, and the *criollo* or white. The *criollo* is the larger plant, but it takes longer to mature and requires a more fertile soil. The yields of both varieties vary from 200 to more than 1,000 pounds to an acre, depending on growing conditions.

There are two growing periods a year in Mexico, one during the dry season under irrigation and the other after the rains begin. The irrigated crop is planted from December to February and harvested from April to June. The rainy-season crop is planted during the summer months and harvested from October to December. Sesame is usually sown as a separate crop, although it is sometimes planted between rows of corn and occasionally is intercropped with castor beans or coconuts.

Sesame is the largest single source of vegetable oil in Mexico. Increased cultivation came about during the war, when the Asiatic sources of vegetable fats and oils were cut off. In 1945, close to 90,000 short tons were produced in contrast to 28,200 tons in 1938. Practically the entire production of this oil seed is consumed domestically. It is normally used in Mexico for edible purposes, but in recent years larger amounts have gone into the soap industry.

NICARAGUA:—In Nicaragua, as in Mexico, sesame has become the most important source of vegetable oil. Small experimental plantings existed before the war, and Nicaraguan production reached 4,500 tons during the 1942–43 season. Most of the output was exported, Nicaragua becoming a leading exporter of sesame to the United States. Sesame exports represented about 7 percent of the value of all Nicaraguan agricultural products shipped in 1943, surpassed only by coffee, rubber, and timber.

The Republic's entire acreage of sesame is located in the western lowlands, principally in the Departments of León and Managua. Only one crop is planted each year, as irrigation facilities are limited. Sesame is sown from July to the middle of September and harvested after the rainy season ends in late November or December. Average yields are around 500 pounds to an acre, although yields as low as 300 pounds were reported in 1943 because of the lack of rainfall.

SOUTH AMERICA:—In Colombia, sesame is grown in the State of Tolima and to a lesser extent in Valle del Cauca. Production has been on the increase during the war years, reaching a peak of 6,800 tons in 1943. Often two crops are produced a year where the farm lands are irrigated, as in Mexico. Yields from 350 to 450 pounds an acre are common. Most of the Colombian production is consumed domestically.

Although output in Venezuela has been on the increase, reaching 3,300 tons in 1944, progress made in the selection and crossing of varieties, under the direction of an agriculturist from the United States, is even more significant. The principal growing areas are in the States of Aragua, Carabobo, and Paraguana. Sowing begins in late summer and extends into the fall, exact times depending upon the rains.

In Brazil, production is still rather insignificant. Most of the sesame cultivation is centered in northern Brazil in the State of Maranhão, but plants are scattered from Amazonas to Rio Grande do Sul.

Sesame is produced also in Peru and Ecuador, though in smaller amounts.

Sesame stalks are usually cut by hand with a machete.

OTHER COUNTRIES:—Other republics in Latin America grow small quantities of sesame. They are El Salvador, Guatemala, Costa Rica, and the Dominican Republic.

UNITED STATES:—In the United States, only experimental plantings have been made in the South and in the States of California and Arizona. Lack of interest in the crop in this country is the result of highly fluctuating yields, the undesirable shattering characteristic of the seed capsules, and the need for large quantities of hand labor, especially at harvest time.

Production Outlook

The production outlook for sesame in Latin America is not expected to show any marked change during the immediate postwar years. The extent to which competitive fats and oils will replace sesame will depend largely upon the internal demand and prices. In several Latin American countries sesame should provide a source of good-quality vegetable oil. In Mexico hydrogenated sesame oil is reported to be popular with the baking trade as a lard substitute. In Nicaragua, because of the lack of extraction equipment, high production levels will depend on export markets, particularly the United States. During 1935–39 the average annual importation of sesame seed into the United States was around 27,000 short tons, primarily from China and India. It was only when the war interrupted the former sources that the United States began to import sesame from Latin America.

Starting off to study bamboos in Ecaudor.

Bamboo in Ecuador's Highlands

A recent trip in the highlands of Ecuador furnished the material for this article, which is an account of observations made rather than a scientific discussion of bamboos. The results of a detailed study of the large series of herbarium specimens collected will be published later.

by F. A. McCLURE

The average traveler in the sierra of Ecuador is apt to receive the impression that bamboo is as scarce in the highlands of that country as it is abundant in the lowlands. This is partly because, with few exceptions, the principal thoroughfares of the highlands do not pass through the bamboo country, the occurrence of which is more sharply localized than in the lowlands, and partly because the use of bamboo is neither so common nor so conspicuous there as in the littoral. Although by no means as important commercially, bamboo does play a larger part than is generally realized in the local economy of the areas where it occurs.

Just as under the general term timber there are many kinds of trees, each with its distinctive characteristics and properties which determine where it will grow, the size it will attain under given conditions, and the suitability of its wood for specific uses, so there are many distinct species of bamboo in the highlands of Ecuador, and they differ in various ways

from those found in the lowlands. Indigenous bamboo flora is found to be far richer here, in number of species, than that of the lowlands.

Genus Chusquea *in the Highlands*

We may, for our present purpose, designate any area with an elevation of 5,000 feet or more as belonging to the highlands. This imaginary boundary between the highlands and lowlands is roughly the limit above which *Guadua angustifolia*, the principal bamboo of Ecuador's lowlands, rarely, if ever, occurs naturally.

Highland bamboos occur most abundantly and in relatively pure stands generally at elevations between 5,000 and 11,000 feet, where the topography and orientation to prevailing winds produce a relatively high atmospheric humidity and ample-to-heavy rainfall more or less well distributed throughout the year. Such situations exist principally along the exterior slopes of the outer ranges of the sierra, and in the gorges that traverse these ridges. In general, the occurrence of bamboo is relatively rare along the more arid inner slopes and inner drainage basins of the sierra. According to present knowledge bamboo is also rare at elevations of 12,000 feet or over, even where moisture is ample. Low prevailing or minimal temperatures apparently enter here as a limiting factor.

The highland regions in Ecuador visited by the writer where the bamboo flora was observed to be most abundant, most dominant ecologically, and most varied are: the well-watered slopes between Paja Blanca and Loma Larga, in Carchi Province; the valley of the Saloya River, in Pichincha Province; the valley above Macuchi; and the valley above Babahoyo through which passes the road to Guaranda, in Bolívar Province.

In all these regions the predominant bamboo species belong to the genus *Chusquea*. In fact, according to indications of present knowledge, the major part of the bamboos of Ecuador's highlands, both in number of species and in area occupied, belong to this genus.

Most of the known *Chusquea* species are plants of small-to-medium stature, with culms less than 1 inch in diameter. A few are erect and some of these have culms as much as 2 inches in diameter, but most are more or less scandent, or climbing, forming impenetrable tangles where there is no support provided by other

Many Ecuadoran bamboos are accessible only by footpaths or pack trails.

plants. All have solid stems, but most of them are soft and pithy, shrinking greatly upon drying and being relatively low in strength and durability.

For Houses, Baskets, and Hats

These bamboos, however, which would, by any standard of comparison as yet available, be classed as inferior, have been given a place of importance in the local economy by the ingenuity of the highland Indian. Wherever, in populated areas, the genus, which is locally called *suro* and *moya*, grows, one sees the culms used in the construction of houses. In the walls the culms serve as a support for the mud plaster, in a type of construction known as *bareque* or *bajareque*. In the roof they are used as sheathing to support tiles or thatch.

Another important use is as weaving materials, especially for baskets and hats. Baskets woven from strips of *suro* are usually made without handles. They are either square or rectangular in shape and are

Species of *Guadua* and *Chusquea* represent, respectively, the lowland and highland bamboo flora of Ecuador and often occur together. Culms of both are sometimes used in the construction of walls of houses.

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generally made in pairs, one fitting over the other, telescope fashion, and serving as a lid if needed. Often, to facilitate transportation to market, which is a major problem, the baskets are made in graded series of 6 to 8 which fit together neatly. These baskets are seen commonly in Quito, Ambato, and other large market centers in the highlands, where they are used for the transportation and exhibition of bread and other food products. The baskets are of rough but sturdy construction, woven from broad strips split from the pithy culms, the two edges of each strip bordered by a band of the tough outer layer of the culm tissue.

Common among the array of things made for the amusement of children and the beguiling of travelers are nests of diminutive baskets, as many as a dozen neatly fitted together in one set, usually cubical in shape, made from fine strips of the tough surface layers of the internodes of a particular species of *Chusquea* dyed in various colors. Patterns of color and weave are striking in variety and artistic appeal. The best of these toy baskets as well as larger ones which are often used as containers for gifts of cakes or fruits, and of hats both for actual wear and in doll sizes, are woven by the Indians of the Otavalo area familiar to visitors to Ecuador's highlands.

The heavy, relatively stronger, and more durable culms of a group of species of *Chusquea* known collectively as *moya* are used, in the regions where they occur, to make ladders, fences, and even the roof timbers for houses. It is said that culms of *moya* were formerly used to make the spindles of banisters which were a decorative feature of the better houses of Quito in an earlier generation. At present, culms of *moya* are said to be used to a limited extent to make

Baskets without handles are among the principal articles woven from split culms of bamboos of the genus *Chusquea*.

Preparing a clearing for the initial trial plantings of native and introduced bamboos at Hacienda La Favorita, Saloya, 6,000 feet above sea level.

vaulting poles and sparring staves for athletic sports in some schools in the highlands of Ecuador.

Unidentified Genera Serve Many Purposes

Bamboos of another genus indigenous to the highlands of Ecuador and known in the vernacular by the collective name *tunda* enter somewhat into the local economy. The known species of the group all have hollow culms with relatively thin walls and their internodes are often very long. In the vicinity of Otavalo the counterpart of our dinner bell or conch is found in the form of a trumpet, called *bocina* or *vocina*, made from a single bamboo internode as much as 2 inches in diameter and sometimes nearly 5 feet long. This instrument is used on the haciendas to call the *peones* to work, to assemble them for special occasions, and to sound the welcome dismissal at mealtime and at the end of the day. When a herd of cattle is being driven along the road to market, a trumpeter with a *bocina* precedes them, blaring the warning to weary travelers on foot to retire to a place of safety from dust and other hazards until the herd has passed.

At Miguelito, east of Ambato, the Indians weave flexible baskets for household and market use from thin nodeless strips of the tough outer layer of the long internodes of a similar but more slender bamboo. The children make blow guns and shepherds' pipes, called *flautas*, from this bamboo. At Cuenca light suitcases and shepherds' pipes are made from the culms of another, as yet unidentified, species of this same genus.

Unidentified bamboos of a third genus, locally called *tundilla* on account of their strong resemblance to *tunda*, occur in the highlands. Their thin-walled relatively fragile internodes make fire-blowing tubes, *fucuneras*, an inexpensive and effective substitute for

the bellows as a means of encouraging a reluctant flame. This bamboo is considered to have potentialities as a source of broom fiber and material for weaving matting and making shades for seedbeds and delicate young nursery stock such as cinchona plants.

A number of commercial establishments and a Boys' Club in Quito under the leadership of Claude Wolfe are actively engaged in making furniture from native bamboos, using modern methods and designs. Results, as indicated by local demand, are encouraging. Limiting factors at present are lack of transportation facilities and inadequate supplies of the superior kinds and varieties of bamboo materials.

Introduced Species

Two oriental species of bamboos were introduced into cultivation in the highlands of Ecuador some years ago by forward-looking officials of the Ecuadoran Government. In 1927 *Phyllostachys aurea* was introduced by Professor Luciano Andrade Marín, at that time Director of Agriculture, who says it came labeled as *P. quilioi*, a synonym of *P. bambusoides*. Plants from this introduction seen by the writer at Professor Andrade Marín's residence in Quito and at the Quinta Normal School of Agriculture at Ambato are unquestionably *P. aurea*.

In 1937 Ernesto Molestina, then Director of Agriculture, introduced *P. aurea* and the Giant Timber Bamboo, *P. bambusoides*. The plants in both introductions were supplied by the California Nursery Company at Niles, Calif. The second introduction arrived in Ecuador in opportune time to be set out at the newly founded Provincial Agricultural Experiment Station located at Ibarra in the highland Province of Imbabura.

The climate in this area is rather arid, and the soil where the bamboos were planted was originally almost pure sand and sterile. Thanks to a flood which occurred a few years ago a layer of fertile alluvial soil has been added. With the aid of irrigation and the improved fertility of the soil, the plants have attained a size and show a degree of vigor not expected of a species of this genus in a region so near the Equator. *P. aurea* has attained a maximum height of about 10 feet, and *P. bambusoides* nearly 15 feet.

Prior to our visit no plants of this introduction had been distributed for trial outside the experiment station. Thanks to the ready cooperation of the director, we were able to secure about a hundred rhizome cuttings of each species for trials in other areas. The principal planting of these was established in September 1945 at Saloya at an elevation of about 6,000 feet, where the soil is fertile, rainfall and atmospheric humidity are adequate, and where species of the genus *Chusquea* abound and luxuriate.

Judging from subsequent observations on this and other plantings, it seems likely that those highland regions of Ecuador where bamboos of the native genus *Chusquea* thrive may prove suitable, at least in part, for the cultivation of some species of the genus *Phyllostachys*, which is native to the temperate regions of eastern Asia. This genus is not expected, however, to attain, near the Equator, a stature equal to that reached in higher latitudes. Experimental plantings of bamboos of the genera *Arundinaria* and *Bambusa* have yet to be initiated in the highlands.

The people in the highlands as well as in the lowlands of Ecuador are already in possession of fundamental and valuable techniques related to the use of bamboo, and they are resourceful in the utilization of the kinds they have. The outlook is favorable for the expansion and improvement of the use of bamboo in Ecuador as more and better kinds become available locally.

Under the leadership of Mr. Eilif V. Miller, Soils Specialist on the staff of the Office of Foreign Agricultural Relations stationed in Ecuador, an exhibit of photographs and of bamboo articles manufactured by Ecuadoran artisans was arranged recently on the premises of the *Servicio Informativo Norte Americano* in Quito. Judging by the press notices and pictures that have just come to hand, the exhibit aroused much interest on the part of various agencies of the Ecuadoran Government and the local people.

Species of the genus *Chusquea* predominate in the bamboo flora of Ecuador's highlands. They often occur in pure stands of considerable size, the tangled culms forming almost impenetrable jungles.

THE RIVERS OF HAITI

by BEATRICE DU FRANE

Haiti, meaning High Place or Place of Mountains, might also be called the Place of Rivers, for more than 40 of the numerous streams flowing down the mountainsides are termed rivers. True, only the largest river, the Artibonite, is considered of much importance, but many of the other streams contribute to the fertility and productivity of the soil, so essential to the economy of an agricultural country.

The Republic of Haiti covers an area of about 10,700 square miles and is roughly the size of Maryland. Approximately four-fifths of the land—about 8,000 square miles—is mountainous, with some peaks rising to almost 10,000 feet. Along the coast and scattered through the mountains are plateaus, plains, and valleys, totaling about 2,700 square miles, most of which are intensively farmed.

The rivers may be grouped into four categories: (1) those flowing north into the Atlantic Ocean, (2) those flowing west into the Gulf of Gonaïves, (3) those flowing north into the same Gulf, and (4) those flowing south, west, or southwest into the Caribbean Sea.

Haiti's principal river, the Artibonite, is about 200 miles long. It rises in the Dominican Republic southeast of the town of Restauración, flows southwest, then northwest, passes through the Grand Saline, and empties into the Gulf of Gonaïves. Its yellowish waters sometimes overflow, depositing a layer of clay and gravel on the surrounding land. The Artibonite's chief tributary is the Guayamouc, Haiti's second-largest river. The Guayamouc flows into the Artibonite from the north, along with the Libon, Oceana, and Thomonde Rivers. Other tributaries of the Artibonite include the Macasía, Juan de Vera, Bois de Verrettes, and the Fer-a-Cheval Rivers. The Artibonite Plain, containing some 200,000 acres, lies along the Artibonite and Estere Rivers. Near the Gulf of Gonaïves, the Artibonite Valley becomes a delta plain, consisting of about 100,000 acres and extending north to the Estere River. This valley provides an agricultural livelihood for some 200,000 people.

The Artibonite, Guayamouc, and Macasía Rivers, with their tributaries, drain the Central Plain, Haiti's largest plain, containing more than 500,000 acres. Although much of this plain consists of tallgrass savannas, that portion southeast of Hinche, the principal city in the area, boasts well-watered river valleys which support a large agricultural population.

The Cul-de-Sac and Blanche Rivers, both of which rise in the Massif de la Selle, drain the western and northwestern portions of the Cul-de-Sac Plain. This plain, containing about 90,000 acres, has been irrigated for over 200 years. It is perhaps the most productive and thickly populated area in the Republic. The capital of Haiti, Port-au-Prince, founded in the middle of the eighteenth century, owes its growth largely to the agricultural productivity of this plain.

The North Plain includes some of Haiti's most fertile land within its 54,400 acres and has been farmed for many years without irrigation. This plain is drained by many streams, including the Grande Rivière do Nord, Massacre, and several others, among which are the Haut du Cap, Marion, Trou, and Tosse.

The Ravine du Sud plays an important part in the agriculture of the fertile Cayes-Torbeck Plain, which covers almost 50,000 acres. Near Les Cayes, where the river empties into the Caribbean Sea, irrigation is carried on extensively. Other streams, also diverted for irrigation purposes, include the Ilet, Torbeck, and Acul Rivers. Irrigation was begun on the Cayes-Torbeck Plain during the latter part of the eighteenth century.

Through the Grande Anse or Jérémie Plain, an area of over 35,000 acres located in the southern peninsula and highly important agriculturally, flow the Grande Anse and several small rivers.

Soil deposited by the Momance and Citronniers Rivers has formed the Leogane Plain, containing about 25,000 acres

The Massacre in the north and Pedernales in the south form part of the boundary between Haiti and the Dominican Republic, the two republics which together comprise the island known as Hispaniola.

The rivers of Haiti have aided in building up the soil resources of about 30 plains and plateaus and have made possible the irrigation of over 100,000 acres. Irrigation, in fact, is used extensively throughout most parts of the Republic.

Haiti lies entirely within the Tropics. Annual temperatures range from 70° to about 87° F. along the coast and somewhat lower in the mountains. During the two rainy seasons, April-June and September-November, some areas enjoy more than adequate rainfall, while others are rather arid. Generally speaking, the northern and eastern slopes of the mountains are blessed with abundant precipitation, while the southern and western slopes lack adequate rain.

All but about 5 percent of Haiti's population of some 3,000,000 persons live on small farms, earning a livelihood by agriculture. The population is concentrated in the valleys and in the fertile well-watered areas of the plains. In addition to Port-au-Prince, principal cities, all located on the coast, include Cap-Haitien, Gonaïves, St. Marc, and Jacmel.

Agriculture is carried on largely on a subsistence basis. Coffee, said to have an excellent flavor, is the leading crop and grows wild in some areas. Bananas, second-most-important commercial crop, have

(Continued on back cover)

ALONG THE *Agricultural Front*

▲ Mexico's Agricultural Research Program

Of interest in the agricultural world is the program of agricultural research which has been operating in Mexico since February 1943 through the cooperation of the *Secretaría de Agricultura y Fomento* of Mexico and The Rockefeller Foundation. At present 7 North American scientists and 22 Mexican agricultural scientists, organized as the *Oficina de Estudios Especiales, S. A. F.*, are engaged in field and laboratory research for the advancement of agricultural science as related to human nutrition in Mexico.

The major projects include research with corn, wheat, beans, and other basic food crops from the standpoint of genetic improvement, disease and pest control, soil and fertilizer studies, and animal husbandry. During the 3 years since the program was inaugurated considerable progress has been made, though it is recognized that agricultural progress can be fully evaluated only on a long-time basis. An extensive collection of corn varieties has been made, furnishing a bank of genetic material for future utilization, and a number of superior varieties for Mexico have been located. Local and introduced wheat varieties have been tested for rust and smut resistance. Recommendations of fertilizers for corn and wheat in Mexico have been made, and forage crops of potential value for Mexico have been collected and introduced. Research on derriengue of cattle has led to the establishment of the cause of this disease as a virus of the pseudo-rabies group transmitted by the vampire bat.

Field work has grown from a single small experimental plot to experimental fields in the States of México, Morelos, Querétaro, Guanajuato, Aguascalientes, Puebla, Michoacán, Coahuila, and Sonora. Thus agricultural problems may be considered with respect to regional limitations. In addition, fellowships for promising young Mexican agricultural scientists have given opportunity for advanced work both in their own country and in the United States.

▲ *Piracicaba Sweet Corn Developed in Brazil*

Because North American varieties of sweet corn are not adaptable to the subtropical conditions of Brazil, the São Paulo State Agriculture College has developed two new varieties of sweet corn by crossing United States and Canadian varieties with Brazilian corn. The new varieties were obtained by crossing American Golden Bantam and Canadian Banting sweet corn with two Brazilian varieties, *Cateto* and *Sta. Rosa*. The resulting crosses are known as *Milho Doce Piracicaba Branco* (White Piracicaba sweet corn) and *Milho Doce Piracicaba Laranja*, (Orange Piracicaba sweet corn).

The new varieties have been planted over a period of 3 consecutive years and are now considered fixed. They are claimed to have the following advantages over Brazilian corn: shorter growing period, greater food value, more tender grain, higher dextrine and sugar content, and the corn remains tender for a longer time before picking.

▲ *Cuba Stops Exportation Of Three Important Woods*

The Cuban Government recently issued a decree prohibiting for a period of 5 years the exportation of mahogany, cedar, and *sabicú* (horseflesh mahogany), whether in the form of logs or sawed lumber. In addition, other species of wood at present subject to export licenses may be exported only with the approval of the Ministry of Agriculture of Cuba.

The decree states that the prohibition on exports was recommended by the National Association of Manufacturers because of the great reduction in Cuba's forest resources, resulting in much higher prices.

Although at one time Cuba was an important exporter of tropical hardwoods, timber resources of the country have been so reduced in recent years that exports of mahogany and tropical cedar have only averaged between $200,000 and $500,000 annually. On the other hand, imports of pine and other softwoods average from 1 to 2 million dollars a year. Cuban hardwoods are used very largely in the manufacture of furniture and railroad ties, whereas imported yellow pine is required primarily for construction purposes.

▲ Panama Announces Agricultural Census

An agricultural census of the Province of Chiriqui, Republic of Panama, will be taken early next year, according to an announcement by the Ministry of Agriculture, Commerce, and Industry. The census is expected to present a picture of the economic and social value of the Chiriqui area and will be a forerunner of a national census which will be taken in Panama in 1950.

CORRECTION

The thatching material known as *bijao*, referred to in the article by McClure "Bamboo in Ecuador's Lowlands" on page 191 of the October 1945 issue of *Agriculture in the Americas* as consisting of leaves of *Heliconia bijao*, actually comes from a species of *Calathea*, as revealed by subsequent identification of flowering specimens made by the author, and as suggested by Eugene F. Horn in a letter dated May 15, 1946.

Reading about the AMERICAS

Opportunities in Latin America, by Ralph Hancock. 278 pp., illus. Duell, Sloan & Pearce, Inc., New York, 1946. The author, who has lived in Latin America for many years, analyzes present conditions and future prospects in the 20 Latin American republics. Under such chapter headings as Postwar Prospects, Social Welfare, Transportation and Communication, Industrial Power, Agriculture, Manufacturing, Mining and Petroleum, Forest Products, Fisheries, and Trade and Travel each country is taken up separately. A series of Pictograph maps show the resources and the lines of communication in each country. The book is designed for the businessman, the investor, and the traveler.

The Fever Bark Tree, by M. L. Duran-Reynals. 275 pp., Doubleday & Company, Inc., Garden City, N. Y., 1946. In this "Pageant of Quinine" is given the story of the struggle, against prejudice and ignorance, for recognition of quinine, the malaria-cure prepared from the bark of the cinchona tree, known as the fever tree. From the first publication, in 1639 in Spain, of a record of the fever tree which was found growing in the high Andes of Peru, to the need for quinine in the tragic days of Bataan and Corregidor, the story is told dramatically. The author has used the method of dividing the book into sections, each dealing with a person or an era responsible for helping or hindering in making quinine eventually available to the world. Some of the chapter headings are: The Countess's Powder, The Jesuits' Powder, The Wonderful Secret of the Englishman, The Breaking of the Spell, Poor Man's Quinine, Bataan and Corregidor, and Of Fevers. A bibliography for each chapter and an index are included.

Esquisse de Mes Voyages au Brésil et Paraguay, by Auguste de Saint-Hilaire; edited by Frans Verdoorn. 61 pp., illus. The Chronica Botanica Co., Waltham, Mass.; G. E. Stechert and Co., New York City; 1946. This is Volume 10, Number 1, of *Chronica Botanica*. It is a reprint of Saint-Hilaire's own account, in French, of his travels in Brazil and Paraguay during the years 1816 to 1822, as given in his introduction to his work on *Histoire des Plantes les plus remarquables du Brésil et du Paraguay*. Although reprinted primarily at the request of a number of South American botanists, it contains also much of a general biological, geographical, and historical interest. An introductory essay in English by Anna E. Jenkins, of the United States Department of Agriculture, furnishes a biographical sketch of Auguste de Saint-Hilaire, including several excerpts from French and English sources.

Venezuela, 1945. 659 pp., illus. El Mes Financiero y Económico, 1945. This is a folio-size, profusely illustrated book on Venezuela, published during the year of the Third Inter-American Conference on Agriculture which met at Caracas, Venezuela. It contains sections on the history, races, culture, and politics of the country; statistics of population, trade, and production of various commodities; cattle raising and agriculture; oil and other industries; government agencies, cities, and education; poetry, music, folklore, art, and sports. There are separate sections on the Federal District and the several States.

Condições de Vida do Trabalhador na Agro-Indústria do Açúcar, by Vasconcelos Torres. 277 pp., illus. Instituto do Açúcar e do Álcool, Rio de Janeiro, Brazil, 1945. A sociological study of the living conditions of the worker in the agricultural industry of sugar in Brazil.

Importancia do Açúcar, by Ademar Vidal. 175 pp. "ASA" Artes Gráficas, Rio de Janeiro, Brazil, 1945. The purpose of this book is to point out certain conditions which have existed for centuries in the growing of sugarcane in some of the regions of Brazil, such as the Northeast.

Editor's Note.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each ease.

AGRICULTURE IN THE AMERICAS — O. R. CARRINGTON, EDITOR

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Gifts of the Americas

CACAO

by OSCAR K. MOORE

Like rubber, corn, vanilla, numerous vegetables, fruits, and nuts, many medicinal and oil-bearing plants, several valuable forest trees, certain domesticated animals, and the turkey, cacao is indigenous to the Americas. Cacao is known as the chocolate tree. It probably originated in the Amazon Basin of Brazil, the Orinoco Basin of Venezuela, or in Central America—no one is certain just where—but the tree grows wild in the two river basins. From its American habitat the chocolate tree migrated throughout the tropical regions of the world.

The tree thrives on deep well-drained soils under conditions found in certain areas about 20° north and south of the Equator. It generally attains a height of 15 feet and may bear for half a century. Cacao beans are borne in pods along the trunk and limbs. The pods are gathered twice yearly and split open with a machete. The 30 to 40 beans removed from each are fermented by heating in sweating boxes and then dried in the open.

Cacao beans are shipped to market, where processors toast, hull, and grind them. The resulting product is a chocolate-brown liquid, which hardens into cakes. From this is pressed the fatty substance known as cocoa butter, leaving a dry substance. The latter, when ground, is powdered cocoa. In place of cocoa and cocoa butter, chocolate may be made from the cakes by processing, sweetening, and flavoring with vanilla. These products are widely used in confections, ice cream, and various other foods, beverages, cosmetics, and pharmaceutical preparations.

Like tea and coffee, cocoa also contains a stimulant, theobromine, which is related to caffein and, when extracted, is used for medicinal purposes. Unlike tea and coffee, however, cocoa contains proteins and carbohydrates of high caloric food value.

Cacao has a rich Latin American history. Centuries ago seeds were carried by nomadic Indians throughout tropical South, Central, and Caribbean America. Spanish conquistadors found it from Mexico to Ecuador, for cacao was known in Mexico to the Aztecs and their predecessors, the Toltecs, and to the Incas of Peru. To the Aztecs, a form of cocoa served as a chocolate food-drink, cacao beans were a medium of exchange, and the beans and tree were used in a religious capacity reminiscent of ancient Egyptian customs. Quetzalcoatl, the mythical gardener of paradise, brought the first seeds to earth, according to legend, and sowed them at Talzitepec. Perhaps this explains why Linnaeus, the Swedish botanist, gave to the variety which today is best known to commerce the name *Theobroma cacao*, or food of the gods, from *theos*, meaning God, and *broma*, meaning food.

Cacao beans were used by Cortez on several occasions to pay his soldiers. As late as 1887, the beans were serving as currency in some remote areas of Mexico and Central America. For centuries, if a Honduran Indian wished to marry, he offered his girl a gift of cacao beans. Acceptance of the gift concluded the proposal. Today chocolate is served at wedding receptions widely throughout Latin America, and mention of chocolate frequently carries inference to a forthcoming marriage.

In the New World, the manufacture of chocolate—from the Aztec word *chocolatl*—was discovered. Sugar, vanilla, and cinnamon were added to cocoa. The Spaniards acquired the recipe and erected chocolate factories in Spain. The formula was kept a secret for years, which, with Spanish colonial trade privileges, gave to Spain's factories a monopoly in its production. Later, when Ecuador and Venezuela became centers of production, contraband trade in cacao beans became so great that factories were erected throughout Europe. The cost of the product was so excessive, however, that only the rich could afford it. Finally, even the extravagant Louis XIV abandoned its use at his famed French court because of the high cost.

About two-thirds of the world's cacao exports today come from Western Africa and one-third from Latin America. Brazil is the latter's chief producer. Other important Latin American producers include Ecuador, Dominican Republic, Venezuela, Trinidad, Tobago, and Costa Rica. Ecuador and Venezuela were once the world's chief growers, but the prevalence of witch-broom and Monilia disease curtailed production. Research institutions are now developing disease-resistant varieties.

The United States, Great Britain, and Continental European countries are the chief consumers. Several cities have cocoa exchanges, large market centers where cacao beans are sold. The New York Cocoa Exchange is the world's major market, and it generally leads in establishing international market prices.

THE RIVERS OF HAITI

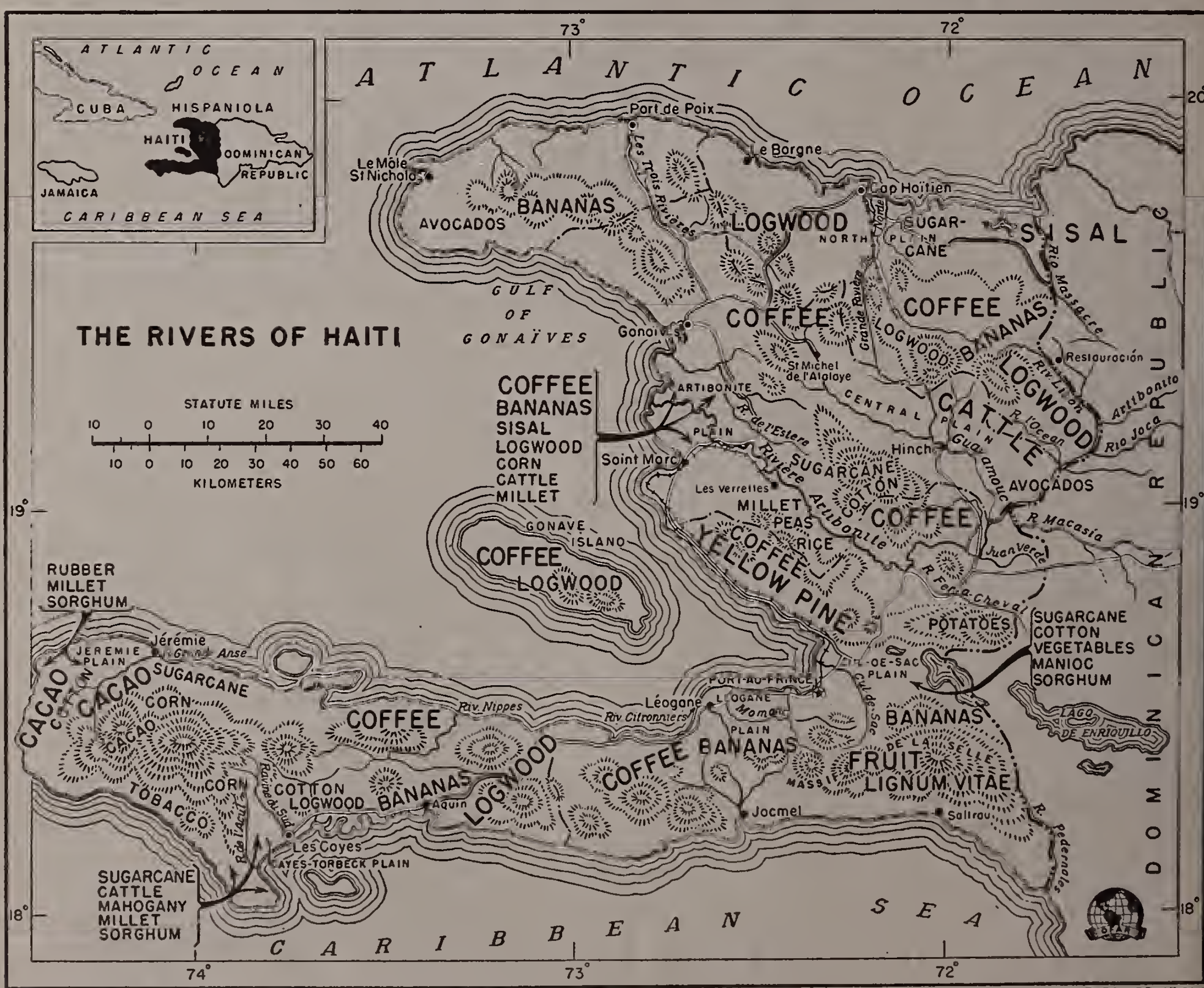
(*Continued from page 168*)

been cultivated since their introduction in 1515 by the Spanish Friar, Tomás de Berlanga. In addition, major exports include sisal, sugar and molasses, cotton and cacao. Cattle raising is carried on chiefly in the grassy areas of the Central, Cayes-Torbeck, and North plains and in the Artibonite Valley. Corn, an important staple in the Haitian diet, is grown widely, and some of it is exported. Other crops include rice, millet, tobacco, peas, potatoes, beans, manioc, and sorghum. Avocados, limes, grapefruit, coconuts, and other tropical foods grow wild along the streams and on the rain-watered mountain slopes.

Lignum vitae, logwood, mahogany, short-leaf yellow pine, and other valuable woods come from Haiti's forests. The production of rubber has been encouraged. Mineral resources, which include gold, silver, copper, coal, sulfur, and others, are not developed.

Having few railroads, Haiti depends largely on its system of highways for transportation. None of the rivers, not even the Artibonite, is navigable by any but small craft for any distance. Logwood, however, is floated down the Artibonite to the sea. The sudden rising and overflowing of rivers, caused largely by the destruction of virgin forests on the mountainsides, is a potential menace to all forms of transportation.

This same denuding of forestland and the resultant floods threaten Haiti's greatest natural resource, the soil. This soil, mainly of limestone origin, is rich in organic matter and exceptionally fertile. Since Haiti depends almost entirely on agriculture for its prosperity and continued development, and since the soil sustains one of the highest population densities in the Western Hemisphere, it is essential that soil erosion be arrested. Reforestation would do much toward accomplishing this end, and, in addition, should eventually provide additional income.



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November 1946

NAMES & NEWS

Joseph N. Crisler Goes to Mexico

Joseph N. Crisler, Plant Quarantine Inspector, USDA Bureau of Entomology and Plant Quarantine, has gone to Mexico to work with officials of that government on the cooperative project for the control of pink bollworm and to prevent its spread into the United States. Mr. Crisler will work principally around Torreon, Coahuila, Las Delicias, Chihuahua, and other cotton-producing areas.

●

E. Alves Ferreira Studies Dairy Industry

E. Alves Ferreira, Instructor, Animal Husbandry Experiment Station, Santa Monica, Brazil, will spend a number of months in this country for the purpose of studying dairy cattle and milk products. Sr. Ferreira was sent to the United States through the Institute of International Education.

●

Victor R. Berliner Assigned to Bogotá

Victor R. Berliner, Animal Physiologist, OFAR, has been assigned to Bogotá and other points in Colombia, under Public 63, to give demonstrations in methods of artificial insemination and other phases of animal husbandry. Until recently Dr. Berliner was Associate Professor of Animal Husbandry at Mississippi State College, where he was responsible for the physiology of reproduction in mule and dairy-cattle breeding.

●

Luiz Cerne Visits United States

Luiz Cerne, Head of Irrigation, Drainage, and Flood Control for the State Government of São Paulo, Brazil, recently visited the United States to observe conditions and to consult with leaders in his field here.

Carlyle W. Bennett Goes to South America

Carlyle W. Bennett, Principal Pathologist, United States Bureau of Plant Industry, Soils, and Agricultural Engineering, is making an extended tour of Brazil, Argentina, Uruguay, Paraguay, and Bolivia, during which he will conduct research on the nature, method of spread, rootstock relation, and control measures of the citrus disease known as *tristeza.* These investigations are of great importance to the fruit industry of the United States since citrus-production methods in Brazil are quite comparable to those used in the United States. Furthermore, a number of Latin-American countries have expressed a deep interest in cooperating with this country in fighting the disease.

●

Wilbur V. Harlan Assigned to Ecuador

Wilbur V. Harlan, Agriculturist, OFAR, recently left Washington for Quito, Ecuador, where he has been assigned to the staff of the Cooperative Agricultural Experiment Station. Dr. Harlan's work will deal primarily with cinchona and pyrethrum and will entail considerable travel throughout Ecuador.

●

Mexican Investigates Muskmelon Industry

Ricardo Gómez y Azcarate, of the Department of Agriculture, State of Morelos, Mexico, spent some time in the United States this summer investigating the muskmelon industry.

●

Juan Macedo Visits 4–H and FFA Projects

Juan Macedo, Principal of the Boys Vocational School, Treinta-y-Tres, Uruguay, is making a special study of projects in dairy, fruit, and vegetable production being carried on in this country under 4–H Clubs and the Future Farmers of America. His trip was sponsored by the Institute of International Education.

Agriculture IN THE *Americas*

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Mexico's New Soil and Water Conservation Program

Faced with serious diet deficiencies in many areas, Mexico is taking an important step toward returning badly eroded farm and grazing lands to productivity. A new law, passed early this year, provides that soil and water conservation practices must be applied to all public, private, and national lands.

by PHOEBE O'N. FARIS

One of Mexico's newest Federal laws decrees that soil and water conservation shall be applied to all the nation's lands—public grants, private agricultural lands, and national lands. Passed early this year, the Soil and Water Conservation Act authorizes the government to assist the people of Mexico in utilizing all known conservation land-use methods and techniques that are applicable to their conditions. The goal is to restore eroded areas to productivity and to prevent waste of soil and water in the future.

Under the new law the Soil Conservation Department of the National Irrigation Commission has been elevated to the status of a Division, with authority and funds to plan and carry out the work on the land. Sr. Ing. Lorenzo R. Patiño, who recently spent many months in this country studying the organization and work of the United States Soil Conservation Service, is in charge of the program. Several of his technicians also have received training with the Soil Conservation Service of the United States.

The law is the most important step in launching a nation-wide program to build an agriculture capable of supporting a much higher standard of living for the people. Nutrition studies made during the second

Twenty years ago Santa María, in the State of Michoacán, Mexico, was a prosperous agricultural center, with fields of crops reaching out in every direction. Today, it is a ghost town, inhabited only by vultures and bats. Soil erosion ruined the land, and farmers moved away. The area is now a part of the Morelia y Querendaro Soil Conservation District, where experimental plantings are in progress to determine species of trees, grass, and shrubs suitable for revegetation of many such regions in Michoacán.

World War showed serious deficiencies in the diet of both city and country people, with real hunger in badly eroded areas, where partial crop failures are the rule rather than the exception. The survey showed that two-thirds of the population depend upon whole corn as a basic part of diet. At the same time, many farmers produce only 3 or 4 bushels of corn to the acre, from fields that have lost their topsoil down to tough, infertile clay or fields deeply gouged by heavy run-off from unprotected mountain slopes.

It is significant that a national soil and water conservation program is being organized at the same time that Mexican authorities are recognizing the fact that food shortages constitute one of the great problems of their country. Already the people are reported to be looking to their new program to increase agricultural production. The program should permit greater per-acre yields from damaged crop-lands and make more adequate use of good grazing land to produce protein foods so badly needed.

Much of the groundwork for Mexico's national soil and water conservation program already has been done. During the past 5 years, and for the first time in Mexican history, all the land of the country has been studied from the point of view of soil erosion. Surveys made by the Soil Conservation Department show that 12 percent of the plains and 30 percent of the steep lands have been made totally unproductive by erosion. To this grave situation must be added the fact that there is great variation in climate throughout the country. About half of the country is semiarid. Other parts are subject to flooding, which regularly destroys entire crops and causes rapid and destructive erosion. An extremely mountainous topography further complicates the job ahead for conservationists. Steep ranges make up 68 percent of the total land area of Mexico, and much of the level land is in small isolated strips between high, eroding mountains.

Ten soil conservation districts, covering most of central Mexico, have been established by the government. These districts include those areas in which soil erosion is most serious. The situation is so critical, in fact, that conservation work must be pushed forward promptly if spread of erosion is to be halted and any appreciable amount of the land is to be saved for agricultural production. In some of these districts, demonstrations established 3 or 4 years ago already have been effective in spreading conservation practices. These include contouring, modern terracing, gully control by structures and planting, reforestation, range and pasture improvement, and grass planting in waterways where sloping lands must be farmed to grow food crops.

The problems facing Mexico's soil conservation scientists and technicians in the soil conservation districts are enormous. In La Malintzin Soil Conservation District, including the entire State of Tlaxcala, destruction of the forests which once covered the Malintzin Volcano has caused formation of huge ravines that descend into the valleys and carry floods of gigantic proportions. The valley floors, formed of volcanic ash, are subject to a most devastating erosion, because of their low permeability. In the short time since the forests were destroyed, Tlaxcala has become one of the most badly eroded areas in the Western Hemisphere.

Conservationists have concluded that only complete revegetation of the volcano and other mountains will stop the spread of this vicious type of land destruction. An experiment station has been established in La Malintzin Soil Conservation District for the specific purpose of testing many varieties of trees, shrubs,

Bench terracing is extremely important in many areas of Mexico where steep lands must be used for growing food crops. This demonstration is in the Tlaxcala Soil and Water Conservation District.

Deforestation and cultivation of steep mountainsides have destroyed millions of acres of Mexican natural forest land. Cornfields, such as these, in the Jacala region of the State of Hidalgo, have been eroded down to bare rock.

grasses, and vines. The object is to find those best suited for rapid revegetation of volcanic soils. The alamo tree has been found efficient for planting at the sides of ravines and rivers to reduce flood damage. Other trees, such as walnut and other nut or fruit-bearing species, are being set out on the riddled mountainsides.

Also tested and proved, and now in use in Tlaxcala for erosion control, is zacaton grass. It has deep and very strong roots effective in holding soils on lower slopes and at the bottom of the glens where there is a little land that can be used for grazing. Zacaton is also valuable as an industrial crop—brushes and brooms being made from its tough roots.

While the revegetation work goes on, the ravines are being controlled mechanically by means of check dams, alignment structures, pilot canals, and other engineering devices. Crop rotation experiments likewise are in progress so that once the flood hazard in Tlaxcala is reduced, farmers can use some of their valley lands to grow food crops while they gradually restore soil fertility. Kudzu, lupines, lespedezas, burclover, horsebean, crotalaria, and several other legumes are under experiment. It is important to determine early which of these plants can be used to best advantage for green-manure crops, cover crops, gully control, hay and forage in mixtures with grasses, and in rotation with corn, beans, and other food and livestock feed crops.

Four soil conservation districts have been established in the State of Mexico. The Arroyozarco District is mostly range land, with the hillsides very badly eroded. The plan here is to establish, as quickly as possible, a protective cover of native grasses on the lands that can be used for grazing while the eroded slopes are being planted and the gullies healed. Both vegetative and mechanical methods are used to stop silting of the valley floors. The Salazar-Cuajimalpa District is only a few miles north of Mexico City, just where the mountains begin to rise as they leave the Valley of Mexico. Here is mainly forest and farm land that has been severely gullied by overcropping and plowing up and down hill. Mangum terraces are being built on the farm land, with grassed waterways provided for safe disposal of water. Results reported thus far are highly satisfactory. Gully control, however, is still a problem in this part of Mexico. Kudzu, used so extensively in the United States for gully control, has proved difficult to establish in this region because of the high altitude.

In the huge States of Michoacán and Jalisco, bordering the Pacific Ocean, three soil conservation districts are well on the way toward completion of plans for a more adequate and safe use of vast areas of range, forest, and cropland. The Morelia-Querendaro District includes the irrigation district of the same name, plus the drainage area of the dams of the project. The central zone of Michoacán suffers heavily from intense sheet erosion, which has caused serious damage to the Irrigation District of Morelia-Querendaro. As water for irrigation is made available for farming and ranching, conservation land use and practices will be applied to the whole drainage area to save water and soil and protect costly structures. Bench and mangum terraces already have proved ex-

Tree seedling beds are being used in Atlihuitzia area of of Tlaxcala Soil Conservation District to find erosion-control plants that will bind the rapidly disintegrating soils of La Malintzin Volcano and surrounding foothills. These plots contain casuarina and eucalyptus.

Phoebe O'Neall Faris is an Information Specialist, U. S. Soil Conservation Service. She is well acquainted with Latin American agriculture, having lived at various times in Venezuela, Colombia, and on many of the Islands of the Caribbean.

Pictures for this article were secured through the courtesy of Foto-Mantel, Mexico, D. F.

cellent for erosion control and for increasing yields on cultivated lands in this district.

Paricutín, world's newest volcano, is located in another soil conservation district that has been established in the State of Michoacán. Studies have been started to try to find ways of reclaiming the large forest and two irrigation districts invaded by lava or choked by volcanic ash. Old volcanic soils are common in Mexico, but this is the first time in history that scientists have been able to start with a huge area of new volcanic land, on which they can study mud flows from the sides of the volcano, the character of the materials in the streams draining the area affected by the eruptions, and the beginning of erosion in newly formed volcanic soils. Experiments already are under way to test various kinds of plants that can be used to restore a cover of vegetation to ash-encrusted areas within the vicinity of Paricutín.

In Los Altos Soil Conservation District, in the States of Jalisco and Guanajuato, the problems are largely lack of water and grass. Every drop of rain must be saved to preserve the native grasses and the livestock industry of the region. A program is planned to build thousands of stock ponds, improve grass stands, and induce ranchers to grow hay and forage to carry livestock through drought periods without excessive use of the range. Some of the range land of Mexico will carry only one head of livestock to each 25 or 30 acres. Dust storms are common, which result in heavy losses of livestock. Conservationists already have started the tremendous job of classifying the total range land of Mexico. They want to find out the capabilities of the soils, where regrassing should be done, areas most subject to drought, and conservation and reclamation practices needed to save vast acreages.

Other soil conservation districts recently formed are the Chapingo and Toluca districts in the State of Mexico; the Jacala-Ixmiquilpan district in the high mountains of Hidalgo; and La Carbonera district in Vera Cruz, bordering the Gulf of Mexico. Topographic, soils, vegetation, and erosion studies are under way in these regions. When completed, they will provide a basis for the necessary land-use adjustments and for putting actual soil and water conservation practices on the land.

This vast program, combining irrigation on nearly half of Mexico's arable land with soil and water conservation on all lands, constitutes an entirely new agricultural technique for the farmers of the country. The Soil and Water Conservation Act provides for an educational program to extend to every school in the country, to farm homes, and to city and village residents, children and adults alike, so they may understand the reasons for and the methods needed to save their land and modernize their agriculture.

The law also provides that the farmers may petition eventually to have the large soil conservation districts broken up into local districts. It provides a program, to start immediately, to train enough technicians to staff many regional and local work units required to aid the people in applying soil conservation methods. The law calls for close cooperation between state and federal governments, forestry, wildlife and public works agencies, and the soil conservation agencies and districts in establishing a land conservation policy throughout all regions and states. Most encouraging of all, the Soil and Water Conservation Act provides for financing a nation-wide program to put the agriculture of Mexico on a conservation basis as quickly as possible.

A farmer of the Salazar-Cuajimalpa Soil Conservation District, who had requested help in establishing soil- and water-conservation practices on his land, receives instruction in the building of contour terraces.

Inter-American Educational Foundation and Its Program

Recent research has shown that many of the educational problems of the American Republics are strikingly similar. As a result of Hemispheric agreements a cooperative program is being carried on in the several countries by the Inter-American Educational Foundation to strengthen educational facilities.

by LLOYD H. HUGHES

The Inter-American Educational Foundation was established by the Office of Inter-American Affairs as a Government corporation on September 25, 1943, for the purpose of implementing long-standing plans for Hemisphere cooperation in the solution of basic educational problems. Research by educators in the last 10 years has shown that the fundamental educational problems of the various American Republics are strikingly similar.

As a result, several recent Hemisphere Conferences have adopted resolutions proposing cooperative action, through bilateral and multilateral agreements, to improve and strengthen educational facilities. Resolutions suggesting such action were approved by the Pan American Scientific Conference of 1940, the Conference of Ministers of Education of the Central American Republics of 1942, the Conference of Ministers and Directors of Education of the American Republics of 1943, and the Chapultepec Conference of 1945.

In undertaking its program, the Foundation operated on the theory that educational cooperation between nations implied a mutual interest, a mutual desire to understand, and a mutual effort to disseminate knowledge of each other's system of education. Viewed from the United States, educational cooperation with the American Republics, in the Foundation's opinion, required a desire to understand the educational and related problems of Hemisphere neighbors, a friendly willingness to assist interested Latin Americans to develop educational philosophies and programs designed to attack and overcome their educational problems, and a genuine and friendly desire to help those south of the border to understand our educational philosophies and programs.

Lloyd H. Hughes is Education Officer for the Inter-American Educational Foundation, Washington, D. C.

Objectives

With these general principles in mind, the objectives of the Foundation were formulated. The general aim was the development of cooperative educational programs in collaboration with the Ministries of Education of the American Republics that would emphasize the improvement of elementary, secondary, and normal schools; vocational and health education, especially in rural areas; the improvement of rural life through community school programs; literacy; and the teaching of the English language.

The more immediate objectives were: (1) To further inter-American relations upon a basis of the fullest mutual understanding among all the peoples of the Hemisphere through educational programs based on cooperative agreements adapted to the needs of the several countries; (2) To raise the general levels of education, literacy, and living standards in the American Republics; (3) To prepare healthy and skilled workers and technicians for the rapidly expanding industrial establishments of the Hemisphere; (4) To develop locally instructional and other materials needed in the several countries; (5) To emphasize the development of community schools, especially in rural areas. A community school, as the Foundation visualizes it, is one that operates as a full-time educational center for children and adults; utilizes the resources of the locality to invigorate the curriculum, which must be based on a study of community structure, processes, and problems; improves the community through participation in its activities; and coordinates all the educational efforts of the region in which it is located. (6) To train nationals of the

Motion pictures are proving a successful educational medium in Latin American countries. Here a group of *campesinos* wait outside a Bolivian rural school to see a film on good-health practices.

various countries as teachers and supervisors to carry on the programs initiated by the Foundation.

Set-up of Programs With Emphasis on Agriculture

The type of collaborative program to be undertaken in any country is determined by the educational authority of that country and not by the Foundation. When a Minister of Education determines the kind of program or the type of assistance that he wants, or even before this, if he requests it, the Foundation assigns an educational specialist to advise him on ways and means of carrying out his program.

All programs are cooperative between the United States and the participating governments. To date, all agreements signed have provided for 3-year cooperative programs, with each participating government, as well as the United States, making a proportionate contribution in funds, material, and personnel. Although the Foundation's support has been guaranteed to these programs for a 3-year period, realization of its objectives will take a much longer time, and all that can be expected in 3 years is the acceptance of the general program by the host country and its integration into the national public school system. By concentrating on one or two major educational problems in each country, it is hoped that during the life of the Foundation's programs sufficient momentum can be developed to insure the continuance of projects initiated.

Every country has its own peculiar problems. Consequently, the type of program has varied in accordance with these problems and the wishes of the educational authorities. Certain things, however, are common to all programs. All provide for sending educational specialists from the United States to work with the Minister of Education and his staff, the development of teaching materials, and the interchange of educators. Since life in Latin America is predominantly rural and agricultural, even in Mexico and Bolivia which usually are thought to be primarily producers of metal, emphasis has been given to agricultural training in almost all programs. This emphasis can be noted in the activities in Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica, Haiti, Brazil, Bolivia, Peru, and Ecuador. In these countries an attempt is being made through the schools to improve agricultural techniques and practices, so that rural diet and economy may be improved.

The interchange of teachers and supervisors is another important aspect of all programs. Teachers and supervisors are carefully selected. Only those Latin Americans who have established positions in education to which they plan to return are eligible for interchange grants. This policy of selection has

been followed to prevent the awarding of interchange grants to persons who merely want to come to the United States for the trip or who on their return home are not assured of positions in some way related to the Foundation's area of operation. The Foundation has insisted that all interchanges be definitely related to and a part of the action programs being carried out in the various countries. Educators from the United States who participate in interchanges are also carefully selected. Only those with the necessary technical competence, language background, and adaptability are selected for service. The Foundation does not assume administrative responsibility for the programs it is assisting to develop, but only gives technical advice and guidance to local administrators who have full responsibility for the execution of the cooperative programs.

Some Programs Already Operating

To date, agreements have been signed and programs are in operation in 14 countries. Though the details of these agreements differ, they fall into three general types. Principal emphasis is on vocational education in the programs of the Dominican Republic, Panama, Paraguay, Peru, and one of the two programs adopted in Brazil. In Bolivia, Costa Rica, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Nicaragua, and in the second Brazilian program the main emphasis is on rural education and the training of teachers for rural schools. In Chile the program is unique and is concerned exclusively with assistance to a Chilean Commission charged with responsibility for the reorganization of secondary education.

Panama's Program Is Vocational Type

Panama represents an example of an exclusively vocational program. Under the terms of the agreement signed by the United States and Panama a 3-year cooperative program was inaugurated. Each country contributed $50,000 to provide for interchanges of educators, the preparation and distribution of educational materials, and the drafting of local projects for the furtherance of Panama's vocational education program. In addition, the treasury of Panama has been authorized to float a bond issue of $2,000,000 to be used in the construction and equipment of a new vocational school in Panama City and smaller vocational schools in outlying cities. Consultant service provided by the Foundation will be used primarily to work with the Government of Panama on the utilization of the bond issue for vocational education.

In response to a request from the Panamanian Government, the Foundation in 1944 sent Dr. George H. Parkes, Director of the Technical Institute of Williamsport, Pa., to Panama to study the vocational needs of that country and to suggest a program based on the best United States practices and adapted to Panama's needs. After visiting many schools, commercial establishments, industrial and technical plants, talking to workmen, foremen, and supervisors, and discussing the problems with many educators, Dr. Parkes recommended a three-unit program consisting of a basic artisan course, a technical course, and a superior course. Following Dr. Parkes' return to the United States, Dr. Nariño Rivera, Director of the Escuela de Artes y Oficios, came to the United States to study under his guidance. He has returned to Panama and is assisting in the planning of the new school.

The program is still in the initial stages, but it shows much promise and indicates the extent to which other countries are willing to go with financial support once their interest and enthusiasm are aroused. This program benefits not only Panama but also the United States. Panamanians, on the completion of their training, will work for the Canal Zone and the United States Army and Navy. Because of the acute shortage of industrial personnel in Panama and the United States, workers trained in this Panamanian vocational school will not be in competition with workers from the United States.

A class in English n a Guatemala City grade school.

A Peruvian farmer receives instruction as part of his country's agricultural education program.

Bolivia Has Rural Education Program

Bolivia's program emphasizes rural education. Recently the Ministry of Education completed a thoroughgoing reorganization of the Department of Rural Education in accordance with plans suggested by Ernest E. Maes, of the Foundation. The objectives of the program are to bring together in one department all rural-education activities, to develop a more practical and functional curriculum, to improve the preparation and training of rural teachers, to interest rural schools in the life and problems of the communities in which they are located, and to make available to rural schools better types of equipment and teaching materials.

Plans have also been made to improve agricultural skills and techniques, to develop the use of more effective tools, and to improve the methods and materials of instruction. Several projects are in operation including: Agricultural instruction for 20 rural supervisors; training in health education for a group of rural supervisors; training in home economics and nutrition for a group of women teachers; and cooperation with Peru in the development of an education program for the Indians of the Lake Titicaca Basin. The Health and Sanitation Division of the Institute of Inter-American Affairs and the Bolivian Development Corporation are collaborating in the development of these projects. In addition, Bolivia is contributing personnel, equipment, school buildings, and franking privileges to the program.

Chile Reorganizes Secondary Education

In Chile the Ministry of Education is planning a complete reorganization of secondary education, and has requested consultants and technical advisers from the United States to assist. This personnel has been requested to make necessary background studies and to advise the Chilean specialists having administrative responsibility for the reorganization. In addition, a number of Chilean educators will come to the United States to observe and study secondary education, and also to lecture and write about Chile and Chilean education. Dr. Harold Spears, one of the leading authorities in secondary education in the United States, has been appointed Special Representative to Chile. He and a staff of specialists in home economics, English, guidance, vocational education, art education, science education, physical and health education, and mathematics have arrived in Chile and are working with Chilean educators in the program of reorganization. One other specialist in social science education has been selected and will arrive there soon. Chile, like Bolivia, is contributing personnel, equipment, school buildings, and franking privileges to the cooperative program.

Collaborative Program A Long-Range One

Through the cooperative education programs, educators of the American Republics, for the first time, are collaborating on an extensive scale. The educational experiences and philosophies of the various countries have been organized into a vast and common pool of knowledge, which is now available to all of the Hemisphere Republics. It is hoped that education in the United States will benefit as much from this cooperative venture as education in any of the other American Republics. Our experience in technical and scientific education can contribute much to the vitalization of technical and vocational training programs in the other American Republics. At the same time, education in the United States can benefit from contact with the humanistic and cultural programs developed by our Latin American neighbors. Intercultural programs in the United States, in particular, can profit from a study of the culture that prevails throughout Latin America.

Results so far are encouraging and indicate that progress is being made toward a solution of fundamental educational problems. Final evaluation of the Foundation's work will have to wait, however, until the generation now in school reaches maturity. Only then will it be possible to measure the Foundation's contributions concretely.

Henri Pittier—
A Man With a Dream

Dominated by an all-absorbing interest in the wonders of plant life, especially in the American Tropics, Dr. Pittier has devoted most of a long and dynamic life to the furtherance of natural science.

by TOBIAS LASSER

The second half of the nineteenth century was tense with rapidly occurring scientific events. Carl von Martius was publishing his monumental *Flora Brasiliensis*, which was to constitute the bible of the naturalist in interpreting the plant world of the American tropics. The spirit of adventure was taking possession of scientists. Spruce explored the hot wet forests of the upper Orinoco and the Amazon and the high cold summits of the Andes, carrying back to Europe numberless rare plants new to science. Like a flash of lightning came the theory of organic evolution as a result of Charles Darwin's observations on his trip covering the entire length of South America. This was the atmosphere in which Henri François Pittier grew up, and he was deeply influenced by it.

He was born in 1857 in Bex, a little Swiss town near the Italian border. The son of mountaineers and reared in the mountains, he grew tall and strong. By the Alpine landscape there was impressed on his character the strength and austerity of rock.

But the mountains shut off the wider horizon; he felt oppressed in the narrow Alpine village. What was beyond those high peaks? He must find out. He went to the University of Lausanne. There the names of Darwin, Martius, and Wallace became familiar to him. As he read books on scientific exploration, he began to dream of himself exploring new worlds. Especially was he attracted by the Tropics, with their exuberant vegetation, their immense climbers, and their rare orchids.

He left the university and began work on a map survey of the Alpine flora. Here, in daily contact with plants and small animals, he found himself free. Then occurred an unfortunate accident which resulted in a fractured leg. During the days of inactivity that followed, he devoted himself enthusiastically to reading and meditation on everything dealing with natural sciences. The articles of Haeckel, then professor in the University of Jena, fell into his hands.

Attracted by the vigorous personality of Haeckel, the young Pittier went to the University at Jena, Germany. There, while he learned the rules of

scientific method and the technique of investigation, he became acquainted with his own mental powers. His personality, to which he was later to owe a large part of his success, expanded into vigorous power.

From Jena he received the degree of Doctor of Philosophy; from Zurich, Civil Engineer; from Lausanne, Doctor of Science. In the University of Lausanne, he taught natural history and physical geography from 1882 until 1887.

In that year he accepted a proposal from the Government of Costa Rica to direct an educational mission in that country. This was an opportunity to become acquainted with the tropical jungle which, as he read the descriptions given by scientific explorers, had colored his early dreams.

Because he needed social and political influence for the success of his mission in Costa Rica, Henri Pittier set out to secure friends who could lend prestige to his project and who were associated with that country's progress. In a short time he presented himself at the Ministry of Education with a report and plans for the creation of the Institute of Physical Geography of Costa Rica, one objective of which was to make a map survey of the Republic. The Institute was to have a meteorological observatory and, among other departments, a section of natural sciences. His dream of exploring in the American Tropics was to be realized.

By this time Pittier was thirty-some-odd years old. He was well over 6 feet tall, with a powerfully muscular and agile physique, keen intelligence, and a passion for work.

There followed long years of exploration in the interior of the country. From these years came a national map of Costa Rica and an herbarium of more than 15,000 plants, duplicates of which he distributed among the principal herbaria of Europe and the United States. This collection was the basic material for *Primitiae Florae Costaricensis*, the work on plants of Costa Rica which he published in three volumes between 1891 and 1901, in collaboration with Theofilo Durand, of the Brussels Botanical Garden. But most important of all, during those years when he was studying the secrets of the tropical jungle he became possessed with the spirit of the forest. From that time on, Henri Pittier would be a professional botanist.

The author is a devoted botanist and is especially interested in medicinal plants. A native Venezuelan, he is a graduate of the Universidad Central. Dr. Lasser also received the degree of Master of Science in botany from the University of Michigan. At present he is Professor of Botany, School of Education, Universidad Central, and Research Associate, Instituto Botánico.

Early in the 1900's, Dr. Pittier came to Washington. Seventeen years of service with the Department of Agriculture gave him the opportunity of exploring parts of Mexico, Guatemala, El Salvador, Panama, Colombia, and Venezuela, where he made valuable botanical collections. During this period he made more than 50 contributions to scientific literature, including revisions of genera, monographs, and descriptions of new species. He was an acknowledged authority on Tropical American flora.

At the age of 62 Pittier was still feeling the call of the Tropics. Besides, he did not like cold weather. In Venezuela the vegetation was little known; a great task was there to be done. He would go to Venezuela and there establish himself definitely.

He accepted a call to Venezuela as Director of the Commercial Museum. There was no school of agriculture or well-organized herbarium; natural sciences were not taught in the university. Pittier worked hard to establish an agricultural experiment school on the outskirts of Caracas, but was successful only in gaining acceptance of a plan for the foundation of an Office for the investigation and exhibition of raw materials of vegetable origin, a plan which tied in with commerce and industry.

From the time he first went to Venezuela his greatest desire was to make a survey of the flora of the country and to leave a permanent record of his work. With that purpose in mind he explored the interior of the country, collecting plants and data on their use. Out of these explorations grew one of his greatest works, *Manual de las Plantas Usuales de Venezuela*, published in 1926, with a supplement in 1939. This publication was a master stroke, for it aroused the interest of the public in their native plants. From that time the people of Venezuela have been with him in his work.

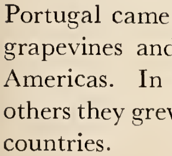
One of Pittier's greatest accomplishments is the National Herbarium at Caracas. For its establishment and recognition he has labored tirelessly. To demonstrate its usefulness as a foundation for later work on the plants of the country, he has published, with the help of the material deposited there, a manual on the Papilionaceae, one group of the Venezuelan Leguminosae.

His publications number more than 300 books and pamphlets on botany, agriculture, geography, and ethnography. He holds active or honorary membership in various scientific and geographical societies, including the Venezuelan Society of Natural Sciences.

Today, at 89 years of age, Henri Pittier, the indefatigable botanizer, is still held by the spell of the flora and forest of Venezuela.

Grapes in Latin America

For wine, raisins, and fresh fruit, grapes have long been grown in Latin America. Now they are coming to the United States as fresh table fruit in the off season when North American grapes are not ripe



by HUBERT MANESS

Before the coming of the Europeans, grapes did not grow wild in South America as they did in North America. In the Old World, however, the growing of grapes was a common practice. It was only natural that when the early settlers from Spain and Portugal came to the New World they should bring grapevines and plant them in many sections of the Americas. In some areas the vines failed. but in others they grew and produced as well as in the mother countries.

Mr. Maness served for 2 years as Vice Consul in the Agricultural Attaché's Office, American Embassy, Rio de Janeiro. He is now Assistant Agricultural Economist in the Office of the American Consulate General, Shanghai, China.

Readily recognizing the high quality of the New World grapes and the possibility of competition, the Spaniards tried to stop grape cultivation in the South American colonies by issuing decrees prohibiting the planting of new vineyards. Such measures served rather to spread the industry to new and distant zones, until grapevines were distributed throughout the colonial areas. Grape growing has prospered in Latin America, until today most of the Americas do not need to import wine and grapes from the Old World, for they produce enough for their own needs.

For years Latin Americans believed that their grape industry was greatly inferior to that of Europe. With the shutting off of shipping facilities to and from Europe during the war the exchange of grapes and grape products between the American Republics has increased. In this way many residents of Latin America have become aware of the high quality of grapes grown there and of the wine made from them.

Argentina, Chile, and Brazil are the leading grape-producing countries in Latin America.

Argentina's Grape Industry

The total acreage devoted to grape cultivation in Argentina is about 320,000 acres. Normal wine production is around 200,000,000 gallons annually. Most of the wine is consumed within the country, though a small percentage of the better grades is exported to other American countries. So large a production places Argentina among the large grape-producing countries of the world.

The leading grape center in Argentina and, indeed, in South America is the Mendoza zone, located in the west-central part of the country near the Andes Mountains, and including the oases of San Juan and San Rafael. In this area there are over 440,000,000 vines planted on some 250,000 acres, producing well over 1,000,000 tons of grapes annually.

In Argentina the name Mendoza is almost synonymous with grapes. Mendoza is an irrigated oasis, over 2,000 feet above sea level. Its large well-cared-for vineyards are irrigated by water coming from the nearby Andean Mountain range. The soil is excellent for grape growing and the climate is among the best in the world. Shortage of water and the prevalence of the phylloxera, or root louse, are the chief problems. The industry has also been faced with low prices for some time and this has caused a decrease in acreage planted to grapes during recent years.

La Vendimia, the annual grape festival, is the climax of the harvest in Mendoza. A queen is selected, and people come from all sections to celebrate, even from neighboring countries.

Most of the grapes are the European vinifera, or wine, species and are used for making wine. Some table grapes are grown, and a small percentage are dried for raisins. A popular variety that is grown extensively is the Muscat. Argentine people consume large quantities of Muscat grapes and are fond of the sweet musk-scented wine made from them. Some are bunch-dried for raisins and are popular during the Christmas festival for decorative purposes and for the making of desserts. Another favorite is the Criolla, which was introduced in the colonial days by the Spaniards and is similar to the Mission grape planted by the Franciscan Fathers in California and New Mexico. Among the popular table grapes are the well-known Spanish Almerias, Red Malagas, and a sultana or white grape called Thompson Seedless.

The Mendoza zone is a thickly settled homogeneous settlement. The various villages and neighborhoods are connected by roads, and numerous churches, schools, and plazas dot the landscape. During the harvest season, most of the picking is done by local men, women, and children, requiring little outside labor. Grapes ripen at slightly different times in different districts, the season extending from January to March, and pickers follow the harvest from place to place. This serves as an opportunity to see old friends, and there is a great exchange of conversation and good will among the workers.

La Vendimia, the annual grape festival, is the climax of the harvest, celebrated at the end of the season. People come from all over Argentina, even from neighboring countries, to celebrate, and the fame of *La Vendimia* spreads each year. Villages vie for the election of the queen, each village championing its own beautiful señorita. When at last the winner is chosen, however, the wounds of the campaign are quickly healed, and the losing candidates become ladies in waiting to the queen. The festival ends with parades, dances, and a great deal of conviviality.

Grapes in Chile

Across the Andes, on the other side of the cordillera from Mendoza, in the Central Valley of Chile, is the second-largest grape-growing area in Latin America. Surrounded by mountains and possessing a mild Mediterranean-like climate, this central valley is truly one of the garden spots of the world. Its large, sweet, juicy grapes produce a rich red wine so fine in quality that Chilean wine is in a class quite by itself.

Grape production is one of the most important industries in Chile. Many of the residents are descendants of people to whom grape growing comes naturally, and they have developed the industry scientifically to a high degree. The dreaded phylloxera prevalent in many grape-growing areas of the world is not a problem in Chile. Over 200,000 acres are devoted to wine grapes, producing about 80,000,000 gallons of wine in normal years. Fifteen million table-grape vines are cultivated also and produce around 30,000 tons of grapes annually.

Chile exports more wine than any other country in Latin America. Much of the wine produced is of a low quality known as Chicha and is consumed within the country, but an increasing number of wineries are producing high-quality wine for export. Before the war cut down shipping space, Chilean wine was gaining much favor abroad, and Chile's exports in 1938 reached 31,000,000 gallons.

Brazilian Grape Industry

Almost the entire Brazilian wine production of around 25,000,000 gallons is consumed at home. Brazil's population of approximately 45,000,000 people makes a large potential market for wine within the country.

In comparatively recent years two commercial grape-growing areas have been developed by the introduction of two varieties of the American Labrusca grape, the Isabella and the Niagara, in the high land extending inland from the Great Escarpment, a series of narrow mountain ranges paralleling the coast from Salvador, Baía, to Porto Alegre, Rio Grande do Sul. The American grape is believed to have been introduced about 1875 by Italian colonists in northern Rio Grande do Sul. Today these two varieties constitute 85 percent of all grapes grown in Brazil.

The Isabella grows well in the climate of Rio Grande do Sul, which is somewhat similar to that of its native home, the Eastern Seaboard of the United States. The Caxias region is the center of the industry, but the grape-growing areas of Santa Catarina and Paraná are generally classified as belonging to the northern Rio Grande do Sul area because of similar climatic conditions. Today 85 percent of Brazil's wine production comes from this area, where an estimated 50,000 acres are planted to grapes.

In the Rio Grande do Sul region fully 80 percent of the grapes grown are Isabella. This variety, the first to prove successful, was probably introduced as a rootstock for the vinifera varieties. It is popular because of its exceedingly heavy bearing and its resistance to phylloxera. It has been known to produce up to 90 pounds per vine, with an average of around 25 pounds, as against the 6 to 8 pounds per vine produced by the Concord, often called Francesa, and by the Niagara. Another reason for the popularity of the Isabella is that it will put out a second crop if the first one is killed by frost.

Other varieties grown in this area are vinifera or vinifera hybrids such as Bonarda, Merlot, Gabernet, Canafolo, Scusao, Barbera, Peverola, Reisling, and Pinot. The finest red grapes are grown in the districts of Caxias, Farroupilha, and Flores da Cunha, but the districts of Bento-Goncalves and Garibaldi are well-known white-grape country. The best Brazilian champagne comes from the district of Garibaldi, where the Malvasia and Trebiano grapes are grown.

The second-most-important grape-growing area in Brazil is slightly farther north in the same coastal range in the vicinity of the cities of São Paulo and Rio de Janeiro. The area is not great, but the acreage is increasing annually because of the demand for fresh table grapes by these two large-city consuming centers. Here the Niagara is grown successfully, centering around Jundiai and São Roque in the State of São Paulo. It is grown as a table grape and is popular in the Rio de Janeiro and São Paulo markets. A sport of the White Niagara has developed in São Paulo which produces grapes equal in size and flavor to the White Niagara but red in color. Cuttings of this new Red Niagara have been sent to the United States. Thus, someone has said, Niagara has come home in a new red gown.

Grape growing in other places along the Great Escarpment is of little commercial importance. There

Courtesy of Benegas Hermanos and Compañía

Grapes have long been an important crop in Latin America. Many thousands of pounds come to the United States as table fruit in the off season.

is some production in Minas Gerais and Baía, and even more in various places in the semiarid regions of the Northeast. In Ceará grapes do extremely well where there is sufficient rainfall or irrigation. Some viticulturists maintain that land and climate in the Northeast are favorable for the development of desirable varieties and that a domestic and export demand for fresh table grapes can be built up.

The cultivation of grapes varies considerably among the different districts of Brazil, influenced by the types of soil, topography of the land, and local customs. In general, grapes are planted on hillsides. The usual care consists of numerous sprayings and keeping down weeds. All of the work is done by hand, the rows being too close together to allow the use of machinery. Often clean cultivation cannot be practiced because of erosion. A few vineyards are inter-cropped, and in some of them a cover crop is grown. During the dormant season the grapevines are pruned according to standard practices.

Many growers in the São Paulo and Rio de Janeiro areas do their grafting in the vineyard. They set out rooted cuttings of wild American grapes and let them grow one or two seasons, then graft other varieties.

Because of elevation and latitude, Brazil's climate allows grapes to mature at a season when few other countries can harvest grapes under natural conditions. Grapes have been known to ripen as early as the first of December in São Paulo, with the main season coming in January and February. Some varieties ripen as late as June. The Labruscas, such as Isabella and Niagara, ripen from late December to March.

In the dry Northeast the ripening season varies and is not clearly determined. It is believed, however, that a harvest could be brought on during the off-season months if the proper varieties could be developed.

Other Producing Areas

Although Argentina, Chile, and Brazil are the major producing countries, substantial quantities of grapes are produced in Uruguay, Peru, and Mexico. In fact, most countries in Latin America produce grapes for home use but have not developed extensive commercial areas, mainly because of unfavorable climate.

In Uruguay grapes are grown mainly for wine making. Normally about 17,000,000 gallons of wine are produced annually. Some American slipskin grapes are grown there, but in general the foxy flavor of American grapes is not popular to people accustomed to European flavors.

Grapes were produced in Lima, Peru, by 1551. Later the industry spread farther south to Nazco and Pisco. It is estimated that at present about 14,000 acres are planted to grapes in Peru.

Grape growing is traditional with the Spanish and Portuguese people, and everywhere they settled in the Americas they tried to grow grapes. In most areas the European varieties failed because of unfavorable climatic conditions, and the introduction of the American Labrusca was slow.

Determination and persistence have brought about the growing of grapes even where their culture is difficult. For example, Portuguese at Manaos, Brazil, have succeeded in growing some grapes in the humid Amazon Valley. They accomplish this by planting the vines in the patios of their homes or in a hole under the floor, where the soil can be kept somewhat dry during the rainy season. The vines are trained to a sun-exposed wall where they get a maximum amount of sunshine. There, by careful pruning and spraying, a few bunches of grapes are produced.

People of South and Central America are not, however, as heavy drinkers of alcoholic beverages as is often attributed to them by North Americans. Per capita consumption of wine, except in Chile and Argentina, is low. In Chile it approximates 20 gallons per person annually, and in Argentina 13 to 14, but in other countries it is around 3 or 4 gallons.

One of the popular drinks on the west coast of South America is Pisco, a strong brandy. It is named after the town of Pisco, one of the early wine-growing regions in Peru.

Trade in Table Grapes

The South American grape season is opposite to that in North America. For this reason, considerable trade in fresh grapes has developed in the past few decades. It was set back somewhat by lack of shipping during the war, but it is expected to revive as soon as shipping conditions permit.

The season for importing fresh table grapes into the United States from South America begins in February and ends in June. South American grapes, which in 1921 were less than 1 percent of our grape imports, in 1936 constituted over 96 percent of our total imports of grapes, and these were primarily out-of-season. Fresh grapes come mainly from Chile and Argentina, arriving in good condition and selling at reasonable prices. United States imports of grapes from Argentina in 1937 were close to 12,000,000 pounds, and nearly 2,000,000 pounds from Chile. Such out-of-season production does not compete with our own, and the North American public is thus able to have grapes the year around.

RIVERS OF THE DOMINICAN REPUBLIC

by CONSTANCE H. FARNWORTH

The Yaque del Norte, Yaque del Sur, Yuna, and Artibonito are the four major river systems of the Dominican Republic but in addition there are numerous smaller streams that empty directly into the sea. The fertile river valleys are the centers of agricultural production.

The Republic is crossed by two important mountain ranges—the Cordillera Central, extending from west to east and dividing the Island into two almost equal parts, and the Cordillera Setentrional to the north which runs from Monte Cristi in the northwest to Samaná Bay on the east coast.

Between these two mountain ranges is the largest valley of the country, the Cibao, about 150 miles in length. Near the city of Santiago, the Cibao is divided into two parts by a low hilly watershed, the western slope of which drains into the Río Yaque del Norte. This river has its source in the Cordillera Central mountains near the Peak of Yaque and extends 250 miles westward from a point in the Cibao Valley just east of the city of Santiago, emptying into the ocean near Monte Cristi. The course of the river is so winding that Columbus, after crossing it several times, thought he had encountered many different streams and gave each turn a different name. Soils of the western part of the valley are relatively fertile although not as fertile as those of the eastern part. There is little rainfall in the western part, and irrigation is essential to agricultural production. Several large irrigation projects use water from the Yaque del Norte River.

The eastern slope of the watershed near Santiago drains into the Bay of Samaná. Here the valley includes the Vega Real, one of the most fertile districts of the West Indies.

On the other side of the Cordillera Central flows the Río Yaque del Sur, which drains a large part of the southwest portion of the Republic. One branch of the river flows through the San Juan Valley where rainfall averages only about 20 inches annually. Vegetation is sparse, consisting chiefly of cactus and thornbush. The San Juan Valley, however, has low hills, plains and prairies with soil above average in fertility. The Río Yaque del Sur, with its branches, empties into the Bay of Neiba at the eastern end of the Enriquillo Valley. Silt in the river, brought there by occasional torrential rains, has built a barrier across the mouth of this valley shutting it off from the sea.

Río Artibonito rises in the Dominican Republic and flows westward across Haiti, draining a large area of the Cordillera Central in the two countries. Other rivers having their sources in the Cordillera Central flow south across the coastal plain. Most of these rivers are short, with wide beds. Few of them are navigable, but they

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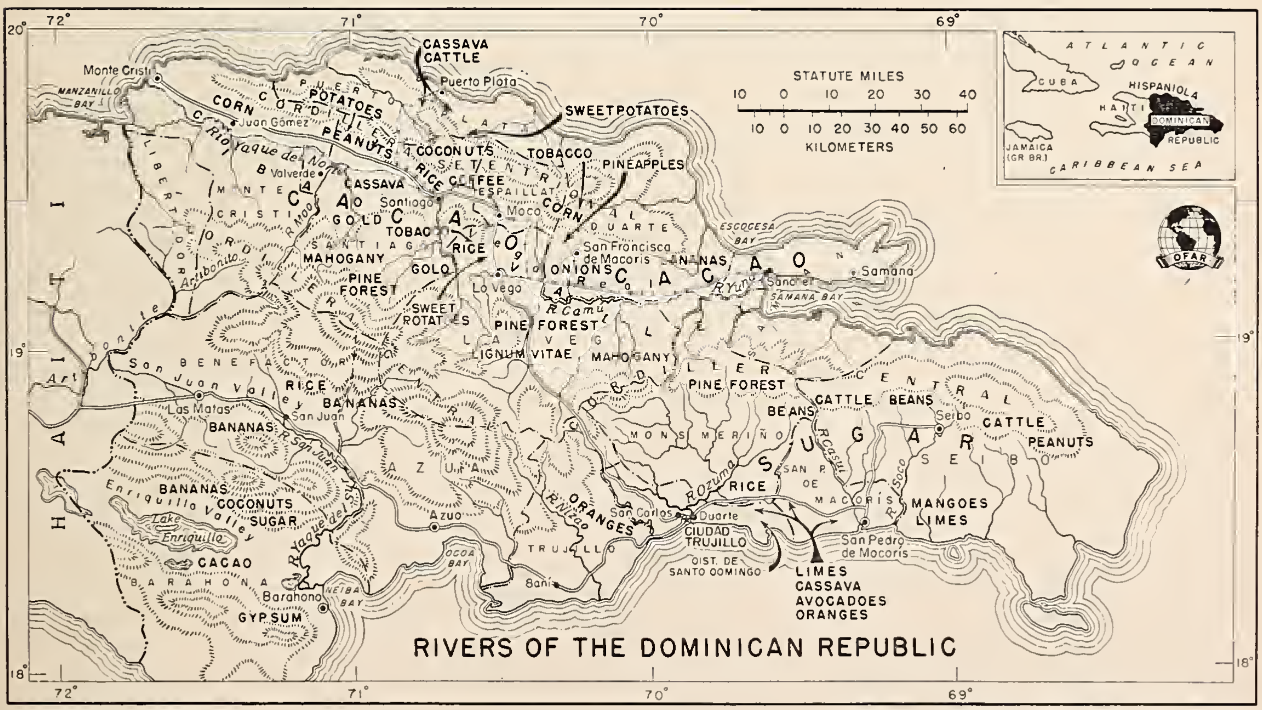

RIVERS OF THE DOMINICAN REPUBLIC

U S DEPARTMENT OF AGRICULTURE NEG 787 OFFICE OF FOREIGN AGRICULTURAL RELATIONS

ALONG THE *Agricultural Front*

Mexican-United States Agricultural Commission Holds Fourth Meeting

The fourth meeting of the Mexican-United States Agricultural Commission was held in Los Angeles July 22–25. The Commission was formed early in 1944 in accordance with an agreement between the United States and Mexico to promote the development of agriculture in the two countries along mutually advantageous long-time lines. The Commission, which functions solely in a technical, coordinating, and advisory capacity, is composed of officials designated by each country.*

The principal subject which was up for discussion before the Commission dealt with two recent shipments of Zebu bulls from Brazil to Mexico. This was held to be contrary to the convention between the United States and Mexico regarding importation of animals from areas where foot-and-mouth disease and other contagious or infectious diseases are known to exist. It was agreed that any new importations of animals from infected areas would be made only through a quarantine station which is to be established by the Bureau of Animal Industry on Swan Island in the Caribbean Sea approximately 100 miles north of Honduras.

The Commission discussed several other matters of mutual concern in animal industry, plant industry, agricultural economics, conservation of natural resources, and exchange of technical information and of technical personnel between the two countries. Provision was made for six committees to carry on activities in these fields until the next meeting of the Commission.

An illustration of the way in which the Commission operates was provided during the meeting when it was informed from Washington that a new insect menace had appeared in California. This insect, known as the grape-leaf skeletonizer, has appeared in grape-producing sections of southern California. Steps are being taken to eradicate the pest, but there was fear that grapes shipped from California into Mexico might carry the insect into that country and form new sources of infestation.

The problem was discussed immediately with the Mexican Section of the Commission, and Mexico agreed to set up a plant quarantine inspection so that the movement of grapes from the infested area will be regulated on a basis similar to that in effect between it and other areas in the United States.

Such direct discussion between the responsible authorities permits prompt action on the part of both countries and saves considerable time which would otherwise be required if such discussions were carried on through normal diplomatic channels.

Following the meeting in Los Angeles, members of the Mexican and United States Sections visited southern California forestry experiment stations, irrigation works, an experimental cattle range, and other projects in which the Mexican members were interested.

Transportation and lodgings during the greater part of this inspection trip were provided by the U. S. Forest Service. The group was accompanied on part of the tour by E. I. Kotok, Assistant Chief of the Forest Service, and by Stephen N. Wyckoff, Director of the California Forest and Range Experiment Station at Berkeley.

Representing the United States at this 1946 meeting were: Leslie A. Wheeler, Director, Office of Foreign Agricultural Relations, who presided as Chairman of the U. S. Section; J. Barnard Gibbs, Agricultural Attaché at the American Embassy in Mexico City; John A. Hopkins, Secretary of the U. S. Section; John W. Carrigan, Chief, Division of Mexican Affairs, Department of State; and nine other persons from various branches of the Department of Agriculture who were present as advisers.

Representing Mexico were: Ing. Alfonso González Gallardo, Mexican Under Secretary of Agriculture, who was Chairman of the Mexican Section; Ing. Gonzalo González, Director General of Rural Economy; Ing. Dario L. Arrieta, Director General of Agriculture; Sr. Ignacio de la Torre, who served as secretary; and eight advisers.

* *See* "Mexico and the United States Discuss Mutual Farm Problems" and "Mutual Planning For Progress in Agriculture," by John J. Haggerty, in the September and December 1944 issues of *Agriculture in the Americas*, and "Mexico and the United States Report on Agricultural Progress," by John A. Hopkins, in the March 1946 issue.

AGRICULTURE IN THE AMERICAS — O. R. CARRINGTON, EDITOR

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U. S. GOVERNMENT PRINTING OFFICE: 1946

Gifts of the Americas

PRIMAVERA

by ELOISE GERRY

"Like golden clouds against the sky" are the pyramids of yellow flowers which crown the tall primavera trees. Small wonder that the Spaniards saw in these trees, with their wealth of bloom, a symbol of spring and named them with the Spanish word for spring—primavera.

Some say the word came from *prima*, meaning first, and *ver*, to see. Certain it is that the flowers are seen first, since they come into full bloom before the leaves appear. The tree is sometimes also called *corteza*, referring to its thick bark, or *palo blanco*, for its white wood, but these names are applied to other unrelated tree species as well.

The scientific name of primavera, *Cybistax donnell-smithi* (Rose) Seibert (synonym *Tabebuia donnell-smithi* Rose), honors the late John Donnell Smith of Baltimore, who made collecting plants, especially those of Central America, a hobby, and whose enormous botanical library and collections were given to the Smithsonian Institution during his lifetime. The flowers of primavera, shaped like those of our catalpa tree, identify it as one of the family Bignoniaceae.

Primavera grows in southwestern Mexico, Guatemala, El Salvador, and northern Honduras, where it is considered one of the most beautiful trees and is used for shade and ornamental planting. Some of the best forest-grown trees have been found along the coast of southern and western Guatemala. Unfortunately there are relatively few trees per acre, for primavera grows in a mixture with other species. Often, too, it occurs in inaccessible places.

Primavera trees have smooth trunks, frequently growing from 50 to 75 feet tall and 4 feet in diameter. Donnell Smith, in 1892, described them as follows: "The trees were too branchless for my servant to climb, too stout for him to fell with his machete, and too high for me to discern what manner of leaves." The trees most often grow on well-drained or even semiarid land. It has been noted that trees grown on moist alluvial soil tend to produce softer, lighter-weight wood with more pinkish or brownish streaks, whereas the wood from drier sites tends to be denser and have a better luster.

The wood, which is odorless and tasteless, is normally creamy white or pale straw-colored, tending toward a light tan, and sometimes becomes a warm yellowish rose on exposure to air. Differences in color between the narrow sapwood and the heartwood are negligible. The pores are small but visible and in size and distribution suggest those that characterize mahogany. Annual growth rings are often narrow.

Although sometimes straight, the grain tends to be interlocked, which gives rise to an attractive figure of broken stripe or ribbon-grain. Some trees have exceptional figures such as roey, curly, wavy, crotch, or swirl. Variations due to differences in coloration caused by streaks and bands of pinkish or brownish wood also occur.

Rated strong in bending and compression along the grain, and moderately hard, primavera compares well with mahogany in these respects, although tending to be slightly less hard and showing somewhat higher shrinkage. It seasons readily without troublesome warping or checking and holds its shape well. It is not resistant to decay in exposed positions.

The air-dry wood weighs 28 to 40 pounds per cubic foot, with a specific gravity of 0.43 to 0.55, which approximates that of mahogany. Because of its similarity in structure and weight, primavera has been used, when stained, as a substitute for natural mahogany. This has led to its being called white mahogany in commerce, but, since it has no relationship botanically to true mahogany, the term is definitely a misnomer.

Principal uses of the imported primavera are in furniture, either solid or veneered, where it has found great favor as a substitute for the popular bleached, or blond, mahogany, and in interior trim. The wood is noted for finishing smoothly and retaining a fine polish.

Although primavera has been marketed in Europe, it is used to a greater extent in the United States, where it has long been an article of commerce. Recently supplies have not been sufficient to meet all demands, and those familiar with the wood and its use, especially in the form of veneer, believe that demands for it will increase still further in the United States.

RIVERS OF THE DOMINICAN REPUBLIC

(Continued from page 189)

furnish water for irrigation and power.

The Republic ranks sixth among countries producing cacao and furnishes about 2.8 percent of the world supply. More than two-thirds of the crop is grown in the Cibao Valley. This valley is a principal center for tobacco and some vegetables. Coffee, peanuts, pineapples, rice, corn, bananas, coconuts, and other tree fruits are grown there in relatively large quantities. The San Juan Valley is noted for rice and bananas, the Enriquillo Valley for bananas, sugar, and coconuts, and the coastal plains for sugar and tree fruits, including limes, avocados, mangoes, and oranges.

The livestock industry utilizes a large part of the arable land in the Republic for grazing. The principal cattle district is in the eastern part of the country, though some cattle for export are raised in the Puerto Plata area in the north. Most meat produced is consumed domestically, but there are exports of hides and skins.

A small amount of mining is practiced on the Island but commercial development has not been large. Some gold has been found in many of the streams in the Cordillera Central and some of the metal has been exported. Gypsum is mined in the Province of Barahona and shipped to the cement mills in San Juan and Ponce, Puerto Rico.

The larger stands of pine forests are found in the Cordillera Central. Frequently hardwoods and sometimes palms are found among them. Pine, lignum vitae, and mahogany are cut commercially. Most of the stands at lower elevations and near highways have been cut over although there are still some thick and commercially valuable growths at higher elevations and away from available transportation. The lumber industry has been increasing since 1930 but its position in the economy of the country is still relatively small.

Most of the industries of the Republic depend directly upon agriculture. These industries include sugar milling, rice and coffee hulling, production of tapioca, chocolate manufacture, tobacco, distilleries, tanneries, and vegetable oil. Most of the transportation business is devoted to the movement of farm produce and more than 90 percent of the exports by value are of agricultural products.

Agriculture dominates the economy of the entire Republic. This would be impossible in many areas of the Island if it were not for the supplies of irrigation water provided by the rivers.

Irrigation

The Dominican Republic depends upon its rivers, especially the Río Yaque del Norte, to supply water for eight irrigation districts. An estimated 120,000 acres were irrigated in 1945 through government-owned projects. There are now under construction projects sufficient to bring more than 30,000 acres under irrigation. Plans for the future call for sixteen canals which should provide water for an additional 50,000 acres. Some privately owned canals water several thousand acres. Major crops grown in the irrigation districts are rice, fruit, and vegetables. Rice production alone increased from 7,500,000 pounds in 1927 to an estimated 100,000,000 pounds in 1945.

Transportation

Motor trucks are the chief means of transportation on the Island. Three main highways connect with a network of secondary roads, some of which are in poor condition. Transportation by truck has increased since more cars and tires have become available, and plans are being made to improve the roads. Many sections of the country can be reached by highways, approximately half of which have been built since 1929. Transportation facilities in the mountains are still inadequate.

Very little is transported by rivers since many of them are not navigable and those that are can be used only for short distances. The Río Yaque del Norte and the Yuna, of the Cibao Valley, are navigable for several miles by small boats and barges. In the south the Yaque del Sur and the Ozuma can be used by small boats for about 20 miles. Other streams are used by canoes, but all of the rivers have numerous rapids and falls which make them impractical for extensive river commerce.

The amount of coastwise transport carried on is surprisingly small in view of the fact that many regions of the Island can be reached conveniently only by sea. There are some railroads in the Cibao region, although the trucks have taken away much of the transportation business formerly handled by them.

Agriculture

Agriculture is the most important industry and the chief source of wealth in the Dominican Republic, supplying about 60 percent of the nation's income and employing about 80 percent of the population.

Sugar is the principal crop of the Republic. Chief producing area for this crop is the coastal plain which covers part of the District of Santo Domingo and the Provinces of Trujillo, San Pedro de Macorís, Monseñor Meriño, and the southern and eastern parts of the Province of Seibo. Several thousand acres of cane are also raised under irrigation in the Enriquillo basin. Production for the Island in 1944–45 was about 407,000 short tons of raw sugar.

Agriculture in the Americas

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December 1946

NAMES & NEWS

Ebeling Studies Mexican Citrus Insect Control

Walter Ebeling, Associate Professor of Entomology, University of California, left late this summer for Jalapa, Vera Cruz, Mexico, where he is conducting research on insect-pest control of citrus. Dr. Ebeling made a similar trip to Mexico under the auspices of the Mexican Government in 1944, and last year he visited Colombia, Peru, and Chile to make a study of pest control in those countries.

●

Horn and Pope Visit Experiment Stations

Claud L. Horn, Head of the Complementary Crops Division, Technical Collaboration Branch, OFAR, and *Dr. Otis A. Pope,* Biometrician, OFAR, have gone to Guatemala, El Salvador, and Cuba, to confer with officials on various research projects being carried on at the several cooperative agricultural experiment stations.

●

Darío Bignoli to Take Special Work Here

Darío Bignoli, Assistant Agronomist, Bureau of Experiment Stations, Argentine Ministry of Agriculture, under the sponsorship of the Institute of International Education, visited the United States this fall to make a study of forage crops and soil conservation methods.

●

Yvan Jolibois Studies at Hampton

Yvan Jolibois, Instructor at the *École Normale d'Agriculture,* Damien, Haiti, recently completed a 3-month summer course in rural sociology and economics at Hampton Institute in Virginia.

Lee Hines Returns To Ecuadoran Station

Lee Hines, Director of the Cooperative Agricultural Experiment Station, Quito, has returned to Ecuador following several months of triennial leave in the United States. The Ecuadoran Station is one of several that have been established by the United States in cooperation with Latin American countries. The stations have as their primary objective the production of strategic and complementary crops.

●

Eilif V. Miller Returns To U. S. for Graduate Study

Eilif V. Miller, Associate Agriculturist, OFAR, who has spent the last 3 years in Ecuador, has returned to the United States to complete work toward his Doctors degree at Cornell University. During his stay in South America, Mr. Miller assisted in the establishment of a soil and chemical laboratory at the Cooperative Agricultural Experiment Station at Pichilingue. His work has included a number of detailed soil studies of certain areas in Ecuador and a complete general survey of the soils of the entire country.

●

Norman Cobbett Returns to Mexico

Norman Cobbett, Veterinarian, United States Bureau of Animal Industry, recently returned to Mexico to observe results of a series of experiments which he started last spring on insecticides for the eradication of cattle fever tick. Rotenone and DDT mixtures have been emphasized particularly in the experiments.

●

Birdsall Receives New Appointment

Dr. Benjamin J. Birdsall, former Director of the Cooperative Agricultural Experiment Station at Tingo Maria, Peru, assumed his duties as Assistant Head of the Station Management Division, Technical Collaboration Branch, OFAR, early in October in Washington.

Agriculture IN THE *Americas*

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Pineapples in Northeast Brazil

Among the most delectable tropical fruits is the pineapple. Originating in South America, it could be grown there more extensively if market outlets for larger quantities were available. This is especially true in the Northeast States, where some of Brazil's best pineapples now grow.

by BENTLEY B. MACKAY

Early explorers in Northeast Brazil found an unfamiliar and strange-looking plant growing in what is now the States of Pernâmbuco and Maranhão. It was the original of what we know as the pineapple. They wrote to Europe about it, and in the early days of colonial Brazil pineapple plants were taken to the Antilles, the Guianas, and to the Azores. From these areas pineapples spread all over the world. Through the years they have been cultivated, selected, and crossed until today there are hundreds of varieties of pineapples, in many shapes, sizes, and colorings.

Grow All Over Brazil

Pineapples can be cultivated in practically every State in Brazil in the open. For most profitable production, rain should be abundant during the development of the plant and the production of flowers and fruits. After the fruit has formed, clear skies and hot sunshine are needed to complete its development and ripening. These conditions prevail in Pernambuco, Paraíba, and Alagoas, and some of the best Brazilian pineapples are produced in those States, where temperatures range from about 62° F. to 88° F., with 96.5° highest absolute, and rainfall varies from about 68 to 88 inches. The writer has seen pineapples producing well, however, under irrigation in the arid lands some 200 miles inland.

Clay sandy loam is preferable to alluvial plain, for the latter tends to produce a fruit which is soft and does not hold up well under shipping conditions. Although in general the soil should be rich in humus, in may places in the Tropics pineapples are grown commercially in soil having a low humus content. The practice of clearing the land and burning the brush destroys much of the humus even before the first plantings. In the States of Pernambuco, Alagoas, and Paraíba the land is hilly, and most plantings are made on steep hillsides. Because of the absorbent nature of the soil there seems to be little erosion. Frequently pineapples are raised on hilly and poorer lands that are considered too dry for sugarcane. Not much fertilizer is used, except for a light application of cottonseed meal at planting time always applied by hand, although Brazilian agronomists recommend a mixture of cottonseed meal, bonemeal, Chilean nitrate, and sulphate of potash.

Cultural Practices, Diseases and Pests

Pineapples are grown not from seed but from suckers, called in Brazil *filhotes*, which grow up from the main fruit stalk, or from slips that grow from the base or the

The author is serving as an Agricultural Officer in the American Consulate, Pernambuco (Recife), Brazil.

The author (center) holds a Pernambucano pineapple of excellent size. At his right is Dr. Paulo Parisio, Secretary of Agriculture, Pernambuco, and at his left, Dr. Heitor Tavares, Director of Experiment Stations, Pernambuco.

top of the fruit. Planting suckers should be chosen from healthy plants known to produce the types desired. They should never be taken from markets or canneries, where the origin of the plant is not known.

For best results, Brazilian agronomists recommend the use of plant beds for starting growths and careful preparation of the field in which the plants will be planted. Often, however, *filhotes* are planted directly, with hoes, in land that has not been plowed. Some of the lower leaves of the suckers should be pulled off and plantings made at approximately 20-inch intervals in rows about 5 feet apart. At this rate, about 13,000 plants can be placed on a hectare, or a little less than 5,300 on an acre. Most of the plantings in Northeast Brazil are from 10,000 to 12,000 plants per hectare, except on the very poor soils.

Dates for planting range in the Northeastern States from September through February; in São Paulo they are from January through April; and in Rio de Janeiro from April through July.

Experiment stations, both Federal and State, have proved the value of frequent cultivation and of mulching the plants. In general practice, however, the only cultivation is the cutting of grass and weeds with hoes and the earthing, or drawing soil up against the plants, also done with hoes.

Apparently the pineapple in the Northeast is not so subject to disease as in some other sections of Brazil, though there are a few that cause trouble. One of these is black rot, *Thielaviopsis paradoxa*, which attacks fruit in shipment. Careful drying of the fruit stem and refrigeration are the best means of preventing black rot. Other diseases of pineapples are a malformation of fruit called bottleneck; a localized rot, *Erwinia ananaz* Serr; and sun scald.

Several insects and fungi do considerable damage. Among the insects are caterpillars which destroy the fruit. The principal one, *Tecla echion* L., of the Licoendae family, resembles the pink bollworm but is somewhat larger. Others are the *Pseudococcus bromelia* Bouché, *P. citri* Risso, and *Diapsis bromelia* Kern.

The Fruit

Pineapple plants grow some 2 to 4 feet tall, with narrow pointed leaves that are rigid and spiny-margined and curve outward. In the center grows a short stem bearing small flowers. On this stem the pineapple develops, a multiple succulent fleshy fruit, crowned with a tuft of small spiny leaves. To prevent too-great leaning or falling of the fruit as it develops on the stem, some growers stake the plants with bamboo poles, tying the fruit just below the crown. Others depend upon close planting to prevent the fruit from falling. Careful producers put wisps of straw over the fruit to protect them from the direct rays of the sun during the months of ripening.

In Northeast Brazil, pineapples are ready for harvesting about 11 months after the *filhotes* are planted. Thus pineapples are a year-round crop. In Pernambuco peak production is reached in September through January; in Paraíba the peak comes in August through December. Most of the fruit from these two States goes to Recife.

The stem is cut just below the fruit, and the pineapples are carried from the field in hand baskets and dumped on the ground in piles. Unless they are to be exported, pineapples are not graded or classified, but are sold by vendors on the streets and in markets and public squares during the season.

If they are to be crated and exported to Argentina, the chief market, pineapples are divided by Government regulations into two classes, white and yellow, and into eight sizes designated by numbers between 16 and 36 according to the number of pineapples which can be fitted into the required boxes. A pineapple of size 16, for example, should weigh at least 1,800 grams, or approximately 4 pounds, and measure 148 millimeters, or a little less than 6 inches in diameter. Size 20, which is said to be the most common in Pernambuco and Paraíba and the type most popular for export, should weigh slightly over 3 pounds and have a diameter of about 5½ inches.

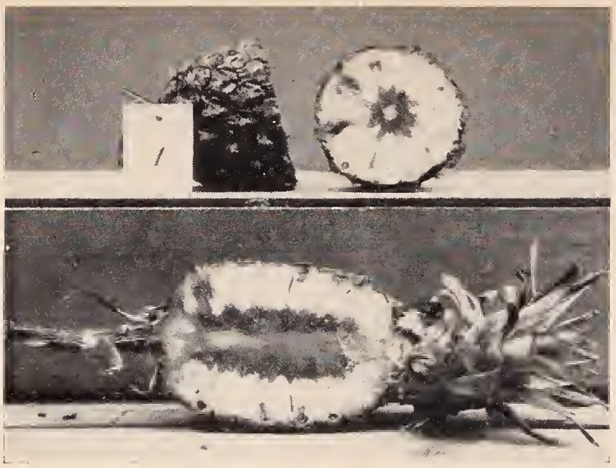
For the Argentine market pineapples are cut with several of the *filhotes* still clinging to the stalk of the fruit. These help to prevent bruising en route, but they are left on the fruit largely because the Argentine market prefers the fruit in this manner.

The pineapple belongs to the family of Bromeliaceae and is known scientifically as *Ananas comosus* (L.) Merr. (*Ananas sativus* (Lindl.) Schult. f.). Although there are hundreds of varieties, eight principal ones are popular in Brazil. *Bico de rosa*, also called *Pico de rosa*, produces small fruit, light red on the outside, tinged with violet or scarlet, and having a delicious odor and taste. When ripe, the inside flesh is yellow and is extremely sweet. *Roxo* is known commonly as the Pernambuco. When ripe, it is red on the outside and is larger than *Bico de rosa* but not so delicate in flavor. *Caradura* has a large crown, and shoots which curve up around the fruit, protecting it well. The type called *Branco* has white pulp with a pleasant taste, and the leaves are whitish. The *Maranhão*, grown in large quantities in the South, is sometimes confused with the *abacaxís* of Pernambuco and is almost identical with *Bico de rosa*. *Amarello* is cultivated widely in São Paulo. It is cylindrical and pyramidal, with a yellow-gold rind, yellow fibrous pulp, has little perfume, and is sour-sweet when quite ripe. This type is suitable for exportation. The *Cayenne*, the largest and perhaps the best type for export, is much like the Hawaiian type. It has been cultivated advantageously in Rio de Janeiro, Pernambuco, and Pará but is not produced commercially. The *Paulista* is similar to the *Amarello* except that the leaves are spineless.

Pernambuco common is the most popular pineapple for export. When packed in a crate for shipping to Argentina the *filhotes* are left on the fruit.

In Pernambuco a distinction is made between *ananaz* and *abacaxí*, the latter being considered superior in flavor and sweetness. A Federal agricultural inspector, in a booklet issued by the State of Pernambuco, says: "The *abacaxí* (*Ananassa sativa* Lindley), some say, is the result of spontaneous hybridization between the common *ananaz* of Maranhão and the wild *ananaz;* others believe that it is a mutation of the ananas reproduced by means of the *corôa* (crown), improved later by perfected cultivation; and

Pineapples are brought to market by oxcart and burros and sold in market places such as this one at São Caetano, Pernambuco. When this picture was taken choice pineapples were selling for from 1½ to 3 cents each.



Pineapples that have been attacked by black-rot disease.

finally there are those who say it is a result of changes in environment, that is, of the abrupt change of the ananas from the *caatingas* (bush) to the coast."

How Many Pineapples

Dependable statistics on production of pineapples are difficult to secure, with the exception of exports, which are fairly accurate. Pernambuco, which is credited with having something over 12,0C0 acres planted to this fruit, produces an estimated 25,000,000 pineapples. Evidently this acreage is interplanted with other crops such as corn or mandioca, or the production of pineapples would be greater. Alagoas is estimated to have about 1,200 acres planted to pineapples, with other crops interplanted. The estimated production of Paraíba is 8,000,000, though that figure may be too small.

Almost every *chácara*, or small country home, has a hundred or so pineapple plants, along with vegetables and various other fruits. The numbers of pineapples grown in this way for individual families cannot be estimated.

Canned Pineapple And Pineapple Juice

There is at present no well-organized canning industry in Alagoas and Paraíba, though an attempt made in 1941 to develop such an industry might have succeeded had the war not prevented. At Recife there are two or three canning factories, and one of the largest plants in Brazil is located at Pesqueira, about 150 miles inland. This factory specializes in the production of tomato paste and extract, guava paste, and other fruit products. It is not, however, in the pineapple district, and its average production of pineapple juice and canned fruit is only about 500 tons. Another plant produced 170 tons of canned pineapple during 1945. Additional machinery has been ordered from the United States, and the industry is expected to increase.

Pineapples Exported

As with all commodities, pineapples have increased in price, compared with prewar days, even though exports virtually ceased. The surplus production was probably absorbed by the additional thousands of United States soldiers and sailors stationed in the Northeast of Brazil and through increased buying power of the people. During the war, difficulties in transportation raised the price of packing cases for exporting the fruit to more than twice the cost of the fruit. Northeast Brazil lacks suitable wood for boxes and crates, as well as for building materials.

Eighty to ninety percent of Pernambuco pineapples for export have always gone to Argentina, even during the period prior to 1938 when shipments were being made to Germany, England, Holland, Sweden, and Portugal. No commercial shipments have been made to the United States, largely because of lack of ships with refrigeration. Most ships putting into Recife continue on to Rio de Janeiro and usually return directly to the United States from Rio. Three cases of pineapples were sent by air express to New York in 1944. Two experimental shipments by boat were planned for last January, but the project had to be abandoned because of shipping difficulties. All consignments to Argentina are unrefrigerated, with from 7 to 12 days being required in transit.

Until there is a market for small, oversized, or imperfect fruit at a fair price, the pineapple industry cannot prosper to any great extent. There is ample available land for expansion, provided growers could be assured of a ready market. In view of the fact that pineapples have been shipped without refrigeration to Europe and stand the 7- to 12-day journey to Argentina, there is every reason to believe that shipments could be made to the United States. Pineapples from the Northeast could be shipped to the United States during the Christmas holiday season when pineapples from other sources are not too plentiful.

The Brazilian Federal and State Governments are advocating a comprehensive program for distribution of *filhotes* of known type and for improvement in implements and methods of production. If adopted by the growers, this program should do much to improve the industry.

Irrigation in Colombia

At the request of the Colombian Government, the author of this paper spent several months in that country, assisting Colombian specialists in a survey of agricultural needs for irrigation and in making recommendations for extensive irrigation systems.

by MILO B. WILLIAMS

Colombia extends farthest north of all the South American countries and is the only one with shores washed by both the Atlantic and Pacific Oceans. Extending from the Republic of Panama south across the Equator over an area more than one and one-half times the size of Texas, it is well situated geographically to contribute many diversified farm products to world markets. Most of the more level soils susceptible to irrigation are fertile. The temperatures and abundance of sunshine are, in the lower-lying areas, conducive to continuous growth, where ample moisture is present. The crops and pastures, however, in the sections where most of the people live are annually reduced and sometimes destroyed by one or two drought periods.

Through numerous farming communities great quantities of water are carried by rivers and smaller streams, often passing on and flooding rich bottom lands or wasting in swamps and the sea. Much of this water could be diverted for irrigation and multiple uses.

Present irrigation in Colombia is confined to small private and partnership developments and a few public projects which are partially constructed. Most of these systems are simple gravity diversions from side streams which flow into the tropical and subtropical Cauca and Upper Magdalena Valleys. Similar enterprises and some pumping from streams are found also in the higher cooler *sabana*, or plateau, around Bogotá and in the Ubaté and other intermountain basins. In northern Colombia near the Caribbean Sea the melting snows of the Nevada Santa Marta Mountains furnish irrigation water for considerable acreages of rice and bananas.

Rivers are potential sources of irrigation water for Colombian agricultural lands. This is the proposed site for a diversion dam in the Río Coello.

Rice growing between young banana trees in the Coello Irrigation Project, southeast of Espinal, Colombia.

Although no agricultural or irrigation census has been taken in Colombia, sugarcane appears to hold first rank in acreage among irrigated crops, followed by rice, pasture, bananas, alfalfa, other field crops, and vegetables. The Colombia Department of Agriculture estimates that 398,000 acres of sugarcane, 180,000 acres of rice, and 3,120,000 acres of other principal crops excluding coffee, were grown in 1944. Both sugarcane and rice are grown extensively in the humid areas without artificial application of water but it seems reasonable to assume that one-half or 199,000 acres of the sugarcane and possibly one-third or 60,000 acres of the rice are irrigated. If it is assumed that 1 percent of the 3,120,000 acres of other principal crops were irrigated, a total of 290,000 acres may be under irrigation in Colombia.

Need for Irrigation In Colombia

Need for irrigation varies greatly in the different parts of the Republic. One must realize at the outset that irrigation will be justified on only a comparatively small portion of the ultimate farmable land because much of the lowlands and coastal areas receive ample, even copious, rainfall, and much of the highland is too mountainous or not accessible to water. In fact, Colombia has few areas sufficiently devoid of rainfall to be considered arid. In the principal agricultural valleys which are now inhabited, however, where annual rainfall is low enough for comfortable and sanitary living and for the efficient planting and harvesting of most cultivated crops, there are usually two annual periods of moisture deficiency serious enough to prevent the maximum growth possible in that hot-to-temperate climate and tropical sunshine. Irrigation is necessary, therefore, in these areas to supply only supplemental moisture for comparatively short variable periods to insure germination of seeds and continuous growth of crops to maturity.

Typical climatic conditions are found in the Department of Tolima in the Magdalena Valley. The accompanying chart displays graphically such a valley's periods of moisture deficiency and the need, during certain months, for extra water to meet crop requirements and evaporation losses. Here irrigation is deemed advisable, and the construction of the Río Coello Project is being planned to carry water to from 40 to 50 thousand acres surrounding the town of Espinal. When sufficient rainfall and temperature records are available, the patterns of moisture relations are almost certain to indicate even greater needs for irrigation in many other localities of Colombia, particularly in valleys and plateaus in the higher Río Magdalena and Río Cauca watersheds, while less irrigation will be indicated in the lower delta and North Coast regions.

Coello Irrigation Project

Economic and agricultural research made in the Coello Project indicates that, if the two annual periods of soil-moisture deficiencies shown on the chart are prevented by supplemental irrigation, the yields of crops can be increased by additional crops per year and increased yield per crop over present annual production about as follows: The increased annual yield of beans, corn, cotton, rice, sesame, tobacco, and yucca will be 460, 200, 180, 900, 220, 140, and 25 percent respectively; the increase in bunches of plantain will be 25 percent; and the number of animals that can be kept on pastures will be increased 166 percent. In addition, it may be found that several fiber and insecticidal crops, sugarcane, pineapples, orchard and small tropical fruits, and many more vegetables can be grown profitably.

The present annual net income from crops and pastures of the approximately 2,500 farmers on 16,000 hectares (39,536 acres) included in the Coello Project is 782,708 pesos, approximately 48.90 pesos to a hectare or $11.31 to an acre. Under irrigation, it is estimated, the annual net income can be raised to more than 3,800,000 pesos, or 385 percent over present income. The estimated net income under irrigation is equivalent to approximately $54.92 in U. S. money per acre.

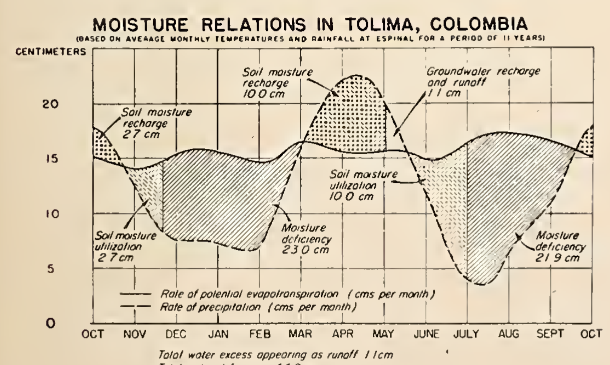
Milo B. Williams is Irrigation Engineer in the Office of Foreign Agricultural Relations, U. S. Department of Agriculture. Recently he served as a member of a mission to Colombia which made a survey of that country's agricultural resources.

Capital cost for construction of diversion structures, canals, and pipe lines to deliver water from the Río Coello to each farm is estimated at about 280 to 320 pesos for each hectare, or from about $65 to $74 to an acre. The ultimate cost of the project, however, will vary considerably with the final areas included in the project, the time taken for the engineering and construction, the current costs of labor and materials, and the interest rates charged on the capital invested.

Considerations For Irrigation Projects

At the present time sufficient soil surveys, hydrological, agricultural, and engineering data, and economic and social analyses are not available for safe irrigation construction except in a very few areas of Colombia. There are, however, a few proposed irrigation projects where general knowledge and statistics on hand seem to justify immediate efforts toward the organization of projects, surveys, designs, and construction. From the standpoint of public advantage to the Republic, Colombia greatly needs to carry out one or two national irrigation projects, which will serve as demonstrations and will assist in the perfecting of its conservation and reclamation agencies, the training of Colombian engineers, lawyers, agriculturists, other technicians, and farmers in irrigation organization, design, development, and administration. An actual public project would also determine and demonstrate the values of supplemental irrigation to Colombian agriculture and society.

In consideration of the great benefits Colombia will realize in the ultimate conservation and utilization of its extensive water resources, it has been recommended that, concurrently with the engineering and construction of the first approved projects, technical, research, and water planning agencies centralize, coordinate,



A stand of cotton which produced only 20 percent of a crop because of lack of soil moisture. This is a typical field that could easily be irrigated through the Coello Project now under construction.

and amplify their activities. This should be done in order to obtain as rapidly as possible, and with continuity, the basic data and relevant information on water and land resources necessary to carry out a safe long-term conservation program.

Recommendations

The recommendations included: (1) A detailed engineering, agricultural, and economic study and census of the present private and public irrigation developments, covering water supplies, soils, crops, irrigation works and practices, costs, and returns; (2) A survey to select, define, and map the principal river drainage basins which contain the most apparent conservation and reclamation problems and where constructed works would give the greatest benefits to people and to the State, and to seek out and map reservoir sites for possible water storage and hydroelectric power developments; (3) Construction, on principal rivers, of permanent stream-gaging stations equipped with automatic recording instruments, establishment of rated stream sections, and installation of staff gages on important tributaries in each selected drainage basin; (4) Establishment of adequate additional rain-gaging and meteorological stations to obtain sufficient long-term weather records for use in determining excesses and deficiencies of rainfall and additional water requirements of crops and lands; (5) Development of irrigation experiments and demonstrations in agricultural experiment stations to determine relations of irrigation to soils, crops, and fertilizers and to demonstrate methods of applying water to lands and crops; (6) Establishment in universities and colleges of courses in hydraulic, irrigation, and reclamation engineering, in irrigation laws, and in irrigated agriculture, to train Colombian students for professions and careers in land- and water-conservation and reclamation fields.

In certain parts of the world where production of corn or wheat would not be feasible because of extremes in heat and drought, grain sorghums are becoming an important item in the agricultural economy.

Grain For Tropical America

At the Inter-American Institute of Agricultural Sciences, located at Turrialba in Costa Rica, many experiments are being made in the cultivation of food and feed crops. This is an account of the experiments in raising grain sorghums.

by JOSEPH L. FENNELL

In certain parts of the world where production of corn or wheat would not be feasible because of extremes in heat and drought, grain sorghums (*Sorghum vulgare* Pers.) have become an important item in the agricultural economy. Not only are they utilized for feeding stock, but they often constitute a major and direct part of the human diet. In China, India, and Africa millions depend upon this grain as a mainstay of their daily existence.

Grains, though of fundamental importance, usually are difficult to produce in the American Tropics. Yet, no group of food plants, save perhaps the legumes, holds so important a place in the economy of tropical and temperate climates alike. For bread and tortillas, for breakfast cereals, and for stock feeds, the grains occupy a place where substitution is almost impossible. The problems incident to their production have caused harsh limitations on the diet and prosperity of rural tropical regions.

Throughout Middle America corn has always been the most important grain crop. In many ways this plant has a relatively limited adaptation and frequently does not give good yields under adverse weather conditions. In many parts of the American Tropics the production of corn on a yearly basis is so low and the cost so disproportionately high as to

render unprofitable its use as feed for poultry and livestock. The scarcity and high cost of such feeds limit production of eggs, milk, and meats so important to the health and well-being of the human population.

In food-crop experiments at the Inter-American Institute of Agricultural Sciences in Costa Rica many types of grain-producing plants have been tested. One of the principal aims of the experiments was to determine the practicability of producing grain sorghums under humid tropical conditions. Although at present this crop is almost wholly produced within regions receiving less than 40 inches of annual precipitation, it seemed highly desirable to determine the plant's ability to produce where conditions involve excess rainfall, as at Turrialba.

Of 11 popular commercial varieties of grain sorghum tested at Turrialba not one offered fully satisfactory results. Dwarf Milo refused to set seed; Kaffir, Hegari, and Shallu gave poor harvests. Feterita was even more of a failure, except in the very driest weather, as a result of molding and rotting of seed before maturity. All the local sorts of broomcorn and sorgo, which largely represent the species in tropical America, bore small hard seeds not relished by livestock. Furthermore, these latter kinds have required from 5 to 7 months to reach maturity. Up to this point grain sorghums offered little encouragement.

New Varieties Of Promise

On the basis of results from these exploratory tests a breeding program with grain sorghums was started. The objectives were to obtain open well-filled heads, moderately large rot-free grains of good quality, and, of course, highest production at minimum cost.

Crosses were made between certain of the varieties that seemed to possess best complementary characters. One of the best of these combinations was Feterita, which has the best resistance to seed smuts, with Shallu, which is considered the most resistant to leaf blights. From the second generation of this cross 10 selections were made from a population of about 2,000 plants. This modest start has given some highly interesting results.

In the fifth generation, 189 line selections were grown, one large plot to each selection. A fair proportion of these lines have shown moderately well-fixed characters and have borne heavy harvests of good grain. One fact worthy of note has been that, although the ripening period was unseasonably humid, seedrot, which rendered worthless the Feterita parent, could scarcely be found on many of the hybrid lines.

One line selection, to which we have applied the name Belleza, in reference to its attractive appearance, usually grows to a height of around 6 feet. It has a moderately good upright habit and broad, open, beardless heads with heavy load of grain. The seeds are of fairly large size and are typically white to light tan in color. They have no bitterness and are relished by poultry. This kind has produced at the rate of up to 3,400 pounds or 62 bushels to an acre in one crop in the preliminary trials.

Another selection, which we have named Enana, meaning dwarf, grows only about 2½ feet high. It is healthy and vigorous with a stiffly upright habit and a moderately open head with short beard. The grain is medium large, of light tan color and good quality, without bitterness. It has seldom suffered from rot or sprouted in the head under any reasonable weather conditions and has produced at the rate of 2,500 pounds of clean dry seed to the acre at Turrialba.

In one comparative yield test, during the same interval (105 days), on identical soil, and under the same adverse humid weather conditions, best local varieties of corn produced only about 9 bushels, or 500 pounds, of shelled dry grain to the acre. Seven times the yield of corn is chalked up for grain sorghum in these tentative tests.

Belleza, a new line selection, grows to a height of around 6 feet, has broad, open, beardless heads, and has produced up to 3,400 pounds, or 62 bushels, to an acre in one crop.

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In climates comparable to that at Turrialba only two crops of corn, one average and the other at best only fair, are produced in a 12-month period. The highest yield of shelled dry corn yet obtained from one crop in our 3 years of experiments has been at the rate of 1,600 pounds to an acre. This applies to the kinds available at the present time, not to some new experimental sorts which have surpassed this yield. Allowing a generous 1,000 pounds for the second planting, the maximum corn harvest that might reasonably be expected from an acre for the entire year would be 2,600 pounds, or 43 bushels. This is considerably less than the yield obtained in 3 months from a few of the new kinds of sorghum raised at Turrialba.

Most of these new grain sorghums in Costa Rica produce three or often nearly four harvests in a single year, and from one original planting. Though it is too early to give definite figures on comparative total yields, a reasonable estimate can be made from past results that Belleza or even Enana and perhaps some of the others would produce in these three successive crops no less than a total of 6,500 to 7,500 pounds, or about 118 to 136 bushels of clean dry grain to the acre. This is more than 2½ times the yield that could be expected with corn from varieties that are at present available.

Average annual yield of the well-known varieties of sorghum grain for the entire United States is given as around 16 bushels, or 900 pounds, to the acre. An unusually heavy yield is stated to range between 25 and 60 bushels, or 1,400 to 3,300 pounds. Thus, one crop at the Institute may equal the best annual yield in the United States, and the three crops per year possible in Costa Rica may yield about twice as much. Furthermore, production at Turrialba required no special fertilizing or cultural practices.

Harvesting one of the new experimental sorghums.

Comparative food value of sorghum grain and of corn is another consideration. Digestible nutrients in 100 pounds of Feterita sorghum grain and 100 pounds of Dent corn, as given in a USDA Farmers Bulletin, are: 10.8 of crude protein and 80.2 of total digestible nutrients in sorghum grain, 7.1 of crude protein and 81.9 of total digestible nutrients in Dent corn.

Several of the new sorghums have been used quite successfully at Turrialba for making pancakes, muffins, tortillas, and breakfast cereals. Additional experimentation along this line is clearly needed, however.

Observations on The Experiments

The results of the experiments strongly indicate that grain sorghums hold almost as much promise for humid climates in the Tropics as for the semiarid. The plant has shown ability to cope with the plagues of disease and insects that often seriously restrict corn development in the tropical lowlands.

Under the heavy rainfall of the Atlantic slope of Costa Rica, which is 100 to 155 inches annually in the region of Turrialba, crop failure has not been experienced in five successive generations with the new sorghum selections, though plantings have been made in all seasons. It should be added, however, that birds may constitute a serious menace.

Although loss from preharvest sprouting during extremely wet weather has been substantially reduced in the hybrids, mostly because of development of open well-ventilated heads, such loss may result if several days of continuous rain or *temporal* catch the crop in full maturity. In seasons or regions where these extremes in weather are to be expected, the precaution has been a good one of harvesting the heads slightly before they are fully ripe and of air-drying them under cover.

If plants are cut back to about 1 foot above ground after seed harvest, most sorghums in Costa Rica will produce an additional crop within about 3 months. As many as eight successive full harvests have been the general rule from one original planting at Turrialba.

The Milk Goat— A Brazilian Foster Mother

Herds of milk goats being driven from house to house are a common sight in some Brazilian cities. Goat milk is used for various purposes. In rural areas a single milk goat is often the only source of milk for the entire family.

by HENRY W. SPIELMAN

The milk goat is the foster mother of many Brazilians, in metropolitan centers as well as in rural areas. In São Paulo, a city of 1,600,000 people, one sees herds of milk goats daily being driven through the city streets to furnish milk for part of the population. Even in the swanky residential sections herds are driven from house to house between 9 and 11 o'clock every morning.

Herds vary in size from 8 to 15 does. The goats are all tied together, with a cord around the neck of each animal. The herd stops automatically at the gate of a regular customer's house, much as the old

Billy goats are frequently used as draft animals in the interior of central Brazil.

Milk is delivered in carts drawn by billy goats in small towns in the interior of Minas Gerais.

milk-wagon horse used to do. The customer hears the jingle of the little bells tied around the does' necks and comes to the door with a cup, glass, or small bottle, frequently selecting the goat from which the milk is to be taken. The herdsman or herdswoman milks the goat directly into the container. As with beer, the customer pays for the foam as well as the milk. From 2 to 10 cents is the charge for each delivery, depending upon the size of the container.

In the larger cities of Brazil goat milk is used by the wealthier people largely for invalid feeding, because many doctors recommend it as being easier to digest than cow milk. Among low-income groups, goats are often the only source of milk for the entire family. In the outskirts of Rio de Janeiro, fifth-largest city in the Western Hemisphere, a large number of milk goats are found, furnishing milk for the factory workers living in those sections.

The usual Brazilian breakfast is bread with *café com leite*, which is a cup of hot milk with a little coffee flavoring. Office workers who eat out or who get up too late to have coffee at home buy their *café com leite* at the corner coffee shop.

Goat milk is widely used because it can be bought on the street by the cupful. It is rarely sold by the quart. An exception was during the acute milk shortage in 1944, when a number of coffee shops in São Paulo served goat milk in place of cow milk and bought it in larger quantities. Dairies handling cow milk or the milk commission, in the city of Rio de Janeiro, sell a minimum of a half liter, which is a little more than a pint. Many families cannot afford a half liter.

Another advantage of goat milk over cow milk is that it does not need to be boiled before being used, as goats are hardy and do not easily catch communicable diseases. Even though grade or type C cow milk is pasteurized in Brazil, doctors recommend that it be boiled before it is used.

A Part of the Family

In the rural sections of Brazil very little goat milk is sold. Instead, a doe is a part of each family, supplying milk for the members as they need it. A farmer in Eastern Minas Gerais said his goat supplied his family of four with milk most of the year. The family consisted of two children under 3 years of age, the father, and mother. The goat is milked as often as milk is needed by the family. In other words, the goat acts as a refrigerator, so that when the milk is used it is always fresh and sweet. This is an important item for families who could not afford a refrigerator or ice, even if they were available; and many people live in places and under conditions where a refrigerator would be useless.

Goats are owned and highly prized by highway and railroad workers who must move frequently. It is a simple matter to load a goat with the other household things in a truck or to crate it and load it in the baggage car of the same train on which the family is riding.

Milk goats are considered pets by many Brazilian families and have at least as important a place in family life as dogs. They are easy to handle, and they require little feed. The owner usually feeds the doe a small handful of corn when he calls her in for milking. She may be fed three or four times a day but the total amount often is insufficient to supply her needs. Most of her feed is made up of what would otherwise be waste material, such as grass growing among the rocks or along the roadside. In the cities goats graze on vacant lots or along drainage canals. During the dry season they are fed chopped sugarcane, manioc, silage, or hay. Under ordinary conditions six to eight goats can be kept on the feed required by one cow.

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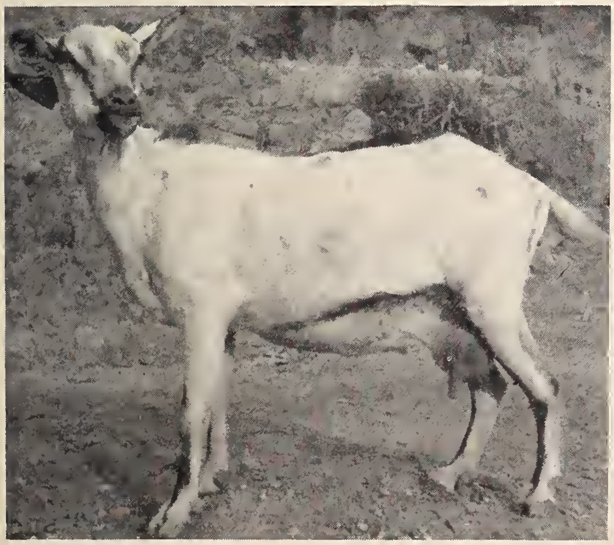
With the exception of worms, goats are not seriously affected by insects or diseases. If they run with cattle, they may pick up the cows' diseases, of which one of the most common among cows in all sections of Brazil is tuberculosis. Animals recently imported into southern Brazil from Europe frequently take cold and sometimes develop pneumonia. Before the widespread use of sulfa drugs, this disease was generally fatal.

Crossing of Native And Imported Breeds

Except in breeders' herds, there are no purebred milk goats in Brazil. There has always been mixing of native breeds regardlesss of quality. This mixing is not as serious as it might be, since the isolation of many of the communities results in inbreeding and tends to preserve pure strains.

Both the Federal Ministry of Agriculture and the São Paulo State Secretariat of Agriculture have imported breeding stock from Europe. The principal breeds have been Toggenburg, Anglo-Nubian, and Saanen. The Toggenburg is the most popular, because of its high milk production and long lactation period. Goats frequently produce from 6 to 8 months. Many of the common goats in the interior show traces of Toggenburg blood. The Anglo-Nubian does are considered good milk producers, but their lactation period is somewhat shorter than that of the Toggenburg. They cross easily with the native goats, producing a vigorous hybrid or mestiço. The cross between the Toggenburg and Anglo-Nubian produces an animal



Typical farm-family milk goats often produce as much as 4 liters (a little more than 4 quarts) of milk a day.

A flock of imported milk goats is owned by the São Paulo Secretariat of Agriculture to supply improved stock to breeders in the State.

with good conformation and high productivity. The Saanen is unsuited to Brazilian conditions and has passed out of existence except in the experimental flock of the São Paulo State Secretariat of Agriculture.

The Toggenburgs and Anglo-Nubians imported by the Federal Ministry of Agriculture were sent to States north of São Paulo. Those brought in by the Secretariat are not sold to the public, but the bucks are loaned to goat raisers, who cross them with the native stock.

The price for a common milk goat varies from $3.75 to $10 in U. S. money, depending upon the length of lactation period. A pedigreed Toggenburg or Anglo-Nubian brings from $25 to $50.

U. S. Chicks to Philippines

About 100,000 baby chicks have been purchased by the Philippine Government from the United States to be used as breeding stock in improving the poultry industry in the Philippines. Three-fourths of the chicks are White Leghorns and the remainder are New Hampshires. An initial shipment of 33,000 of the chicks arrived in Manila by air from California in 43 hours, accompanied by an attendant, who reported they reached their destination in good condition. They were all produced under the National Poultry Improvement Plan and certified as U. S. Pullorum Controlled, or better.

ALONG THE *Agricultural Front*

▲ Brazil to Increase Production of Farmlands

To aid the domestic food situation, as well as to provide supplies for shipments abroad, government officials in Brazil are striving to revitalize and expand their country's farm production.

Major over-all objectives in the Brazilian campaign for greater agricultural output include adoption of better farming practices, establishment of commodity prices reflecting profit to the producer, improvement of transportation facilities, and proper land-use planning.

The Brazilian Ministry of Agriculture is emphasizing greater mechanization of farm equipment and is seeking to obtain tractors from the United States and to train drivers to operate them in sections where they can be used efficiently.

The campaign for greater production is being carried to the farm level by means of visits of technically trained advisers to the farm, by expansion of seed multiplication fields, increase of animal breeding stations, and offensives against plant and animal pests and diseases. The Brazilian Government also plans to sell machinery, fertilizer, and other supplies to farmers at cost in installments without interest.

▲ Offer Plan to Aid Panama's Agriculture

A plan for improving agriculture in Panama was recently presented to the National Assembly of that country by a Board for the Promotion of Agriculture. The plan calls for improvement of farm land in areas which are easily accessible for transportation, increase in farm equipment, construction of "farm to market" roads, and establishment of a suitable public market for the sale of farm products.

▲ Porto Alegre Milkshed Area to Be Increased

Because of shortage in the present production of the Porto Alegre, Brazil, milkshed and the necessity for developing new production areas, the State Government of Rio Grande do Sul has issued a decree-law providing for a special fund of Cr$3,000,000, or about $360,000, for the purpose of building fresh-milk receiving and pasteurizing plants at Gramado and Cai. The present plant at Carlos Barbosa, which is the receiving station for the Entreposto do Leite, will be maintained and enlarged. The reasons given for expanding the milkshed area are the relatively poor quality of soils and the hazards of drought in the present producing area, and the increased demand for all dairy products in Porto Alegre.

A number of milk-collecting stations will be constructed at various points in the territory surrounding Porto Alegre but these stations will not be equipped for pasteurization. Provision is made for transportation by motorboat to Porto Alegre of milk which is produced along the various rivers.

The new law also provides for the purchase of land and the establishment of a number of model dairy farms near Porto Alegre which will be large enough to provide for all the needs of the dairy herds and for additional livestock, such as hogs and poultry.

▲ Cattle Shipped To Guatemala by Air

Air freight companies in the United States are offering to ship dairy cattle from Wisconsin and other States in the Middle West to Guatemala. So far, cattle shipped by air from this country to Guatemala have arrived in excellent condition within 24 hours.

▲ Peru Establishes New Meteorological Stations

The Peruvian Government recently approved the establishment and installation of 22 second-class meteorological stations which will be "charged with the study of the conditions of the weather and the supplying of pertinent information to farmers, travelers, aviation companies, and, in general, to all those who need to know atmospheric variations."

According to the decree the new stations will be located in the valleys of Tumbes, Chira, Chancay, Jaquotepeque, Chicama, Moche, Rímac (where three stations will be installed), Acarí, Majes, and Moquegua y Uchusuma.

The new stations will greatly strengthen the work of those already in existence and should be of especial benefit to landowners of Peru in the study and gaging of rivers for irrigation purposes.

▲ Cattle Association Representatives Visit Latin American Countries

Representatives of the Holstein-Friesian Association of America, Brattleboro, Vt., recently visited a number of Central and South American countries for the purpose of arousing the interest of dairymen in registered Holstein-Friesian cattle. The Association is now offering special services to responsible breeders in the United States seeking to export Holstein-Friesian cattle, as well as to buyers of such cattle. This includes the issuance, when warranted, of certificates of registration and inspection. These certificates are designed to maintain the quality level of animals.

▲ New Dam Planned For Mexican River

Plans have been completed by the Comisión Nacional de Irrigación (Mexican National Irrigation Commission) to begin construction of the Endo Dam on the Tula River in the State of Hidalgo, Mexico. The new dam will be constructed of about 1,000,000 cubic yards of rock and 784,000 cubic yards of earth fill.

RIVERS OF COSTA RICA

by MARY S. COINER

The rivers of Costa Rica are numerous and swift. On the whole they are small, but significant as a source of an estimated 1,000,000 horsepower. With the exception of the San Juan all spring from the volcanic cordillera which traverses the length of the country. Because of their mountainous sources they run off rapidly, either directly into the ocean or into the coastal plains, where their course is slower.

Flowing east from Lake Nicaragua is the San Juan. It is the largest river in Costa Rica and the only one navigable to large-sized boats. It forms most of the boundary between Costa Rica and Nicaragua and with its tributaries, San Carlos and Sarapiqui, drains the northeastern plains. The Frío rises in the mountains, flows a short distance across the plains, and empties into Lake Nicaragua. Guanacaste Province is watered by the Tempisque and its tributary the Bebedero, flowing into Gulf Nicoya.

Mt. Irazú and its foothills are the source of several rivers. The Reventazón, or Parisima, rises in the foothills and drains the southeastern basin of the Meseta Central into the Caribbean Sea. The Sixaola takes its way across the level region southeast of Limón, emptying into the sea near the Panama border. On the Pacific side, the Tárcoles rises in the foothills and drains west, watering the northwestern basin of the central plateau and entering the Gulf of Nicoya south of Puntarenas.

South of Cartago and extending into Panama lies the Cordillera de Talamanca. Southwest of this range stretches the broad El General Valley, drained by a river known successively as El General, Diquís, and Río Grande de Térraba. The river flows southeast, then turns sharply to the west and empties into the Pacific.

The cordillera, in which most of the rivers rise, produces a diversity of soils and climate in an otherwise uniformly tropical country. There are three distinct climatic zones, depending on elevation, each of which contributes in a different way to the agricultural economy of the country.

From sea level up to 3,200 feet is found the torrid zone, with a temperature range of 77° F. to 100° F. Here are coastal plains and river bottoms, generally forested or grassy. On the Pacific side there is a dry season from November to April, but on the Atlantic side rain falls 300 days of the year. Bananas and cacao are the chief products of this hot, humid zone.

The temperate zone, which includes the Meseta Central, is from 3,200 to 6,500 feet in elevation. This central plateau is the heart of Costa Rica. Four of the largest inland cities are situated here—the capital, San José, Heredia, Alajuela, and Cartago. The climate is pleasant, with temperatures from 59° F. to 77° F. and with regular rainy and dry seasons. Costa Rica's fine aromatic coffee is the chief agricultural product.

Least extensive and least populated of the three zones, the cool zone lies above 6,500 feet. Mountains break up the tablelands, and farming is difficult. Some dairying is carried on, and fruits and vegetables are grown on a comparatively small scale.

Rivers, in general, are not important as means of transportation in Costa Rica, although large portions of Guanacaste are accessible by waterways. Products of the San Juan basin are shipped out in barges, canoes, and small boats.

There are some 1,800 miles of roads, of which about 625 are maintained by the Government. About 330 miles are all-weather and are located mostly on the Meseta Central. The main line of the Costa Rican and National Railways runs from Limón through Siquirres, Turrialba, and Cartago to San José, with a spur extending to Heredia and Alajuela. The Pacific Electric Railway continues from San José to Puntarenas.

Agriculture is the most important industry in the river valleys, as indeed it is in the entire country. Almost all of the population is concerned, directly or indirectly, with agriculture and its products. The economy of the country is based principally on three export crops: coffee, bananas, and cacao.

Coffee is grown in all provinces except Puntarenas. The principal producing areas are in the Meseta Central, where the rich volcanic soil is ideally suited to coffee growing. In 1945 the value of coffee exports was about 65 percent of the value of total exports.

The Atlantic coastal plain with its fertile alluvial soil and humid climate was formerly the center of banana production, but the ravages of sigatoka and Panama disease caused commercial production to shift in 1938 to the Pacific coast. For a time no shipments left the east coast, but in March 1944 bananas again started moving from Limón. The best of this fruit comes from the San Juan River basin, while small farmers along the railway lines supply the rest.

Cacao, ranking third as an export crop, is grown chiefly in the Province of Limón, following the railroad from Limón west to the Reventazón River and southward to the Panama border. Many former banana plantations have been shifted to cacao production, which likewise absorbed some of the labor formerly employed in the banana industry.

Besides the three export crops, considerable acreage is devoted to the cultivation of food crops. On small farms scattered throughout the country patches of cereals, vegetables, bananas, and other fruits are grown for domestic use.

One crop of comparatively recent development in Costa Rica is abacá. Of the 11,500 acres under cultivation, 6,000 acres are at Good Hope and 5,500 at Monte Verde plantations, both near the railroad between San José and Limón.

Among the various branches of livestock raising in Costa Rica the

(Continued on back cover)

Reading about the AMERICAS

Farms and Farmers, by William H. Clark. 346 pp., illus. L. C. Page & Co., Boston, Mass., 1945. This is the story of agriculture in North America. Beginning with "Savage America" in 1660, the chronicle continues through: the Colonial Period; the Great Expansion of 1784–1861, when cotton became King and machinery began to lighten the farmer's labor; the years 1861–1929, when the frontier ended, a tide of farmer discontent arose, and, in the response of Federal and State Government, agriculture "came of age"; the "tin can age"; and on to the age of conservation, regimentation, and science. Included in the chronicle are the stories of the Grange; of the creation and work of the United States Department of Agriculture, with several of its Divisions; of Farm Banking, Weather Bureau, and experiment stations; and of the introduction of some of our fruits from Latin America.

El Manzano y el Peral, by Ing. Oliverio Tellez. 106 pp., illus. Ediciones Agrícolas "Trucco," Mexico, D. F., 1945. The author discusses the cultivation in Mexico of apple and pear trees—the zone and land conditions, varieties, methods of propagation, planning and conserving the orchard, and pests and diseases.

Strange Customs, Manners, and Beliefs, by A. Hyatt Verrill. 302 pp., illus. L. C. Page & Co., Inc., Boston, Mass., 1946. During more than 50 years of expeditions as naturalist, ethnologist, author, and artist to less-frequented parts of the world, the author has encountered many peculiar customs and beliefs. This book contains his stories, illustrated by his own drawings, of strange ways of treating the sick, of headdresses, tattoos and taboos, charms, deadly weapons, marriage customs, and strange foods and drinks. The territory covered ranges from some of our own amusing superstitions of today to customs of the Aztec Indians of Mexico, and from the mountains and jungles of South and Central America to the islands of the South Pacific and the floating farms of the Far East.

Pequena História do Café no Brasil, by Affonso de Escragnolle Taunay. 558 pp., tables. Departamento Nacional do Café, Rio de Janeiro, Brasil, 1945. This is a condensation of a 12-volume work on the history of coffee in Brazil from 1727 to 1937. It traces the spread of coffee production southward and westward from the Amazon Valley into Rio de Janeiro, Minas Gerais, and, more recently, São Paulo and Paraná. It discusses virtually every economic and political event in the development of coffee production in Brazil, showing the tremendous drive as coffee became the dominant Brazilian crop. A table of coffee exports from Brazil between 1821 and 1941 is given.

Jungle Journey, by Jo Besse McElveen Waldeck; illustrations by Kurt Wiese. 255 pp., illus. The Viking Press, New York, 1946. *Jungle Journey* is an account of a trip which the author made with her zoological-collector husband up the Cuyuni River into the jungle of British Guiana. It gives a sympathetic picture of Arawak Indian life, the tribe with whom the Waldecks spent several months. She learned how to make cassava bread, the stew called "altogether," and the fermented drink of milk squeezed from the pulp of the cassava roots, and to twist thread from the "wild cotton" found in the jungle. When she left the Indians, she bore on her arm the five small blue cuts administered by Mano Sue, the friendly old jungle woman, proclaiming her "Me Sister" of the Arawak tribe. The beauty, the mystery, and the terror of the Guiana jungle are clearly portrayed.

As Flacourtiáceas Antilepróticas, by Helena Possolo. 132 pp., illus. Secretaria da Agricultura, Indústria e Comércio de São Paulo, Brasil, 1945. This is a study of the oils from Flacourtiaceae seeds used in the treatment of leprosy. Special emphasis is given to a botanical, pharmacological, and chemical study of the genus *Hydnocarpus*. An 11-page bibliography is given.

EDITOR'S NOTE.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

AGRICULTURE IN THE AMERICAS — O. R. CARRINGTON, EDITOR

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U. S. GOVERNMENT PRINTING OFFICE: 1946

Gifts of the Americas

CRANBERRY

by BERENICE A. ZANDER

As American as the holiday turkey are the cranberries served with it. The Indians were using cranberries as relish with venison before the early New England settlers arrived, and they showed the newcomers how to find and use the acrid swamp berries.

The name cranberry, or craneberry, is derived from the appearance of the opening bud with its long stem, short calyx, and tube of extending petals, which resemble the neck, head, and bill of cranes.

America has four cranberry species: *Oxycoccus macrocarpon* Ait. (formerly *Vaccinium macrocarpon*), the large-fruited cranberry which is native only to the acid marshes in temperate North America, growing as far north as Newfoundland, as far south as North Carolina, and west to Wisconsin and Arkansas; *O. vitisidaeus minor; O. microcarpus;* and *O. quadripetalus*. Northern Europe and Asia have *O. vitisidaeus*, *O. microcarpus*, and *O. quadripetalus*, which bear much smaller berries than the American species.

In South America edible red or reddish-purple berries from the Andes are seen in markets of Colombia, Ecuador, Venezuela, and northwest Brazil. Often mistaken for cranberries by tourists, these berries belong to the genus *Psammisia*, native to cool frostless mountains. Some have juicy fruit about cranberry size, intermediate between cranberry and blueberry in sweetness. They grow on twining vines and have dark-red flowers. Another Andean genus with edible reddish-purple but insipid berries is *Cavandishia*, some species of which have showy flowers in immense clusters.

Both in North America and in Europe and Asia the value of the cranberry is wholly as a commercial food crop. Except for the crimson of their autumn foliage, the plants are not particularly ornamental. Among the Ericaceae, or heath family, however, to which they belong, are such highly ornamental shrubs as rhododendrons, laurels, and azaleas, and the lovely trailing arbutus.

Cranberry culture started in Massachusetts. Captain Henry Hall initiated it about 1810, when he transplanted some vines to his garden. After his notable success the culture spread to other centers. Now Cape Cod, first in output, produces about 70 percent of the world supply. Wisconsin, New Jersey, Washington, and Oregon come next.

Cranberries are among the most specialized and interesting of pomological crops, and their culture is a highly technical enterprise. Growers consider money invested in bogs tolerably safe. Information on how to raise cranberries is easily obtained and the plant is easy to cultivate, but the processes required to bring the cranberries into bearing make them one of the most expensive fruit crops.

Acid peat or acid sandy-peat soil is essential, and it must be a soil that will not bake. A bog is built as level as possible and should consist of several layers—for instance, clay hardpan, sand, 10 inches or more of peat, and, on top, 3 to 5 inches of clear coarse sand. Layers in different bogs vary greatly; some have peat many feet in depth. In the clear top sand, cuttings of runners are planted in rows and spaced much as corn is.

A water system adequate for drainage and flooding is necessary. Flooding is done to protect the plants from frosts in early spring and late fall, from severe freezing weather in winter, and from insect pests in June. Good drainage controls water rot, which may be worse than either frost or insects, and provides good aeration for cranberry roots.

In about 5 years a bog becomes a full producer. The first season after planting, numerous 4- or 5-foot runners appear. The next year these produce upright bearing stems. The third and fourth years more runner and stem growth helps to crowd out weeds and grasses. By the fifth year the ground may be covered with a thick matting of vines, and the bog be in full bearing. A very good crop is about 200 to 300 bushels an acre.

In Wisconsin, the method of harvesting that is cheapest and least injurious to the vines is to flood the bogs and rake or scoop up the berries as they float on or near the surface. Care and speed are necessary to prevent spoilage. In other sections bogs are not flooded, and berries are harvested with scoops or are picked by hand.

A single potted cranberry plant makes a striking holiday centerpiece, and cranberry garlands enhance the beauty of the Christmas tree. Cranberries are delicious served as jelly, as a drink, in muffins, in steamed pudding, and as part of the fruit in mock cherry or mince pie, but by many people they are considered best when served as cranberry sauce with roast turkey.

RIVERS OF COSTA RICA

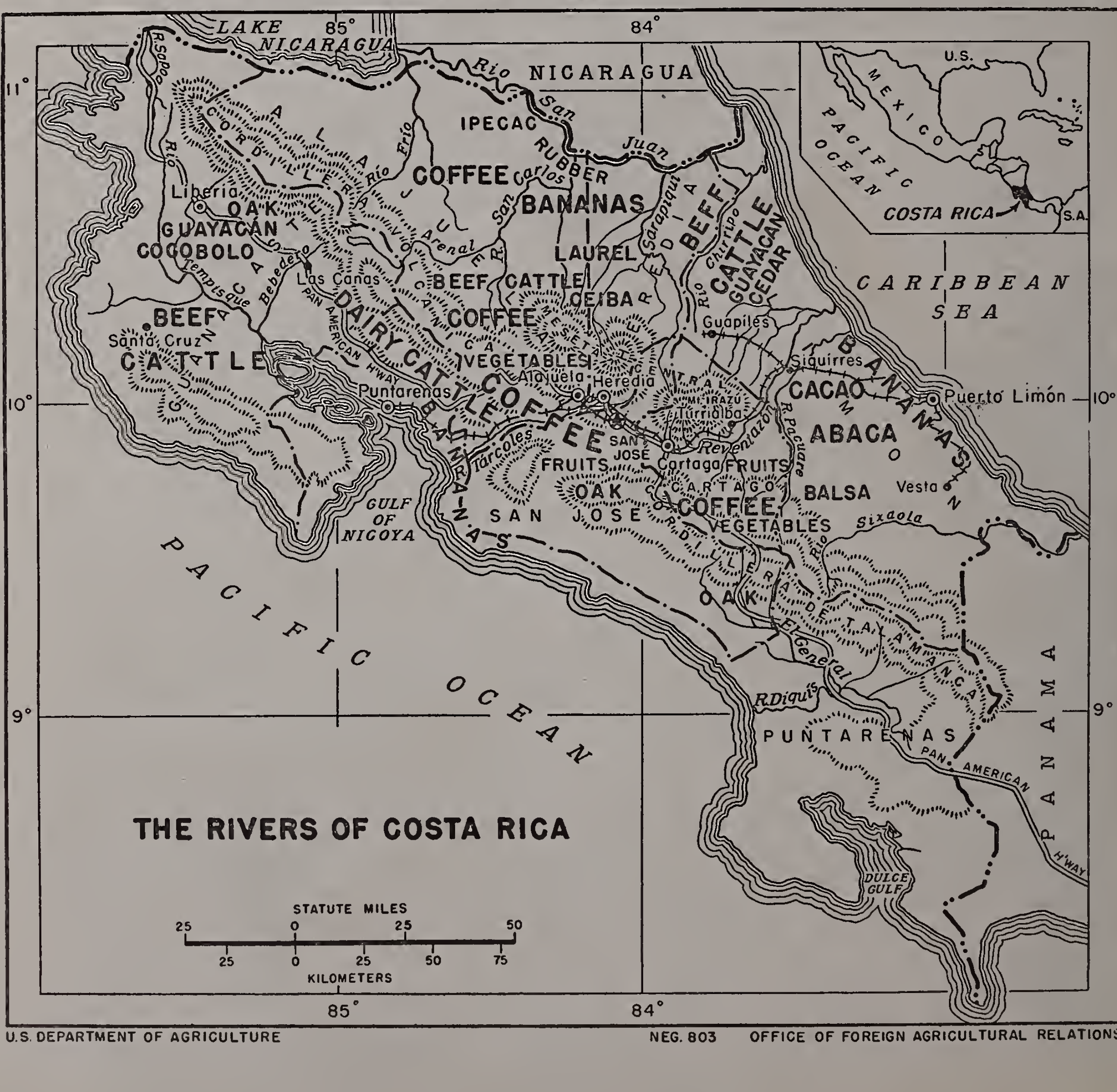
(Continued from page 209)

dairy industry is most important. Dairy cattle are raised from the tropical seacoast up to the cool highlands 10,000 feet above sea level. Most dairying is carried on in the Meseta Central near the centers of consumption. The beef-cattle industry belongs largely to the lowlands. Guanacaste Province has the largest number of beef cattle. Here large sections of savanna and open forest land are devoted to grazing. The industry also is expanding in the San Carlos Valley and eastern plains.

Most of Costa Rica's agricultural lands have been hewn from the forests, and this process is continuing; but the San Carlos Valley, the jungles between the Atlantic coast and the Cordillera de Talamanca, El General Valley on the Pacific side, and most of the cordilleras themselves are still heavily forested. Spanish cedar, balsa, ceiba, guayacán, and laurel are but a few of the species covering the territory drained by the branches of the San Juan River. Oak, cocobolo, guayacán, and other hard durable woods grow in wide belts along the streams in Guanacaste and the Peninsula of Nicoya. Oak forests covering the mountain tops are undisturbed by cutting and are largely unexplored.

In addition to lumber, the forests of Costa Rica furnish small amounts of ipecac and wild rubber. Both are found growing wild in the northern forest lowlands, especially south of Lake Nicaragua and the San Juan River.

The Pan-American Highway seems at present one adequate means of opening up many fertile but undeveloped areas. Further development of Costa Rica's agricultural and forest resources would be encouraged by the extension of roads into productive river valleys.



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UNITED STATES DEPARTMENT OF AGRICULTURE

OFFICE OF FOREIGN AGRICULTURAL RELATIONS

Agriculture in the Americas

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